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CANADIAN GEOGRAPHICAL JOURNAL

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This magazine is dedicated to the interpretation, in authentic and popular form, with extensive illustration of geography in its widest sense, first of Canada, then of the rest of the British Commonwealth, and other parts of the world in which Canada has special interest.

Contents

JULY, 1938 VOLUME XVII No. 1

COVER SUBJECT:—Fine dry sand, mingled with the water of the tide or of the rain begins to "run" and assumes these leaf-like shapes.

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The British standard of spelling is adopted substantially as used by the Dominion Government and taught in most Canadian schools, the precise authority being the Oxford Dictionary as edited in 1929.

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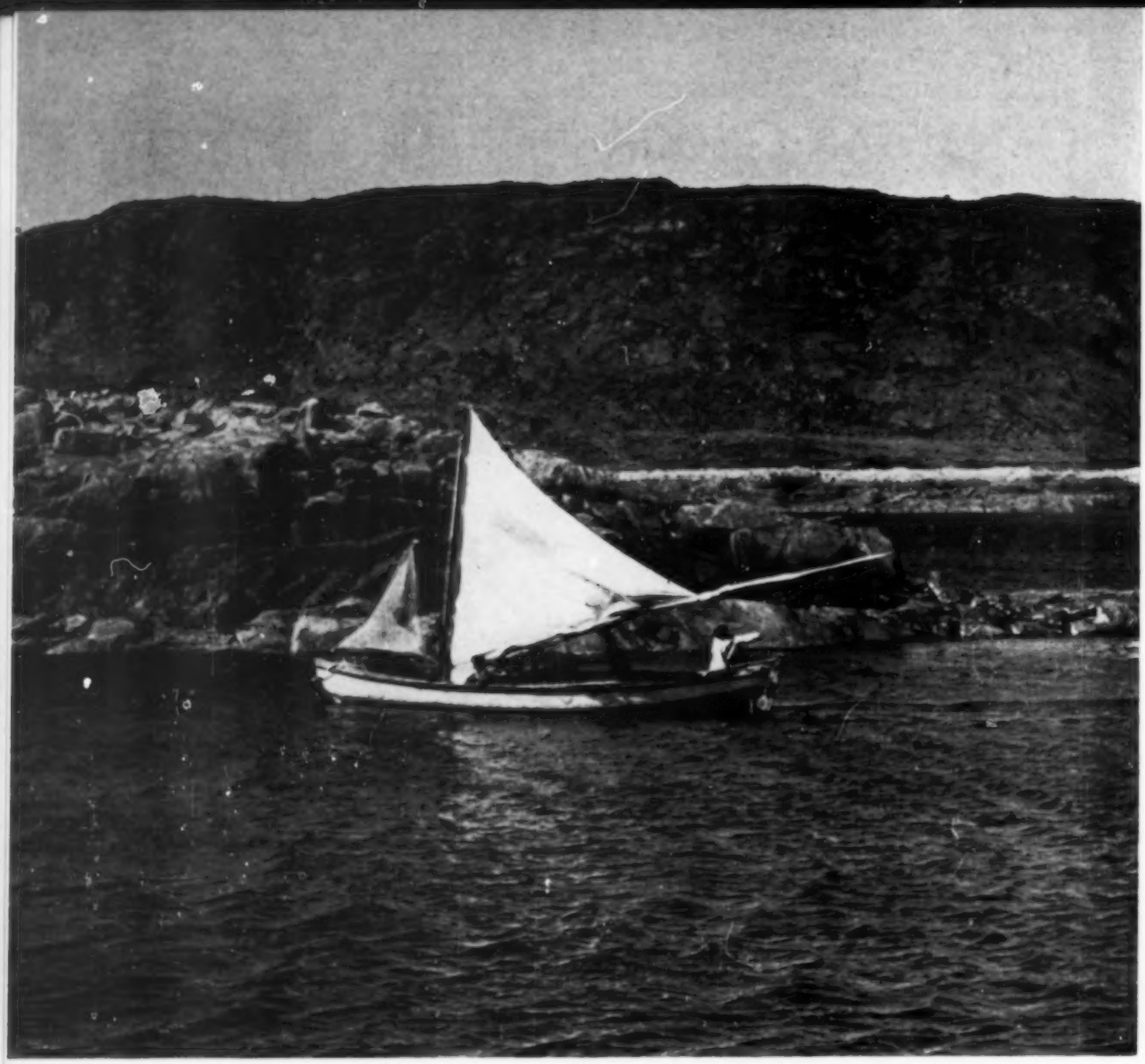
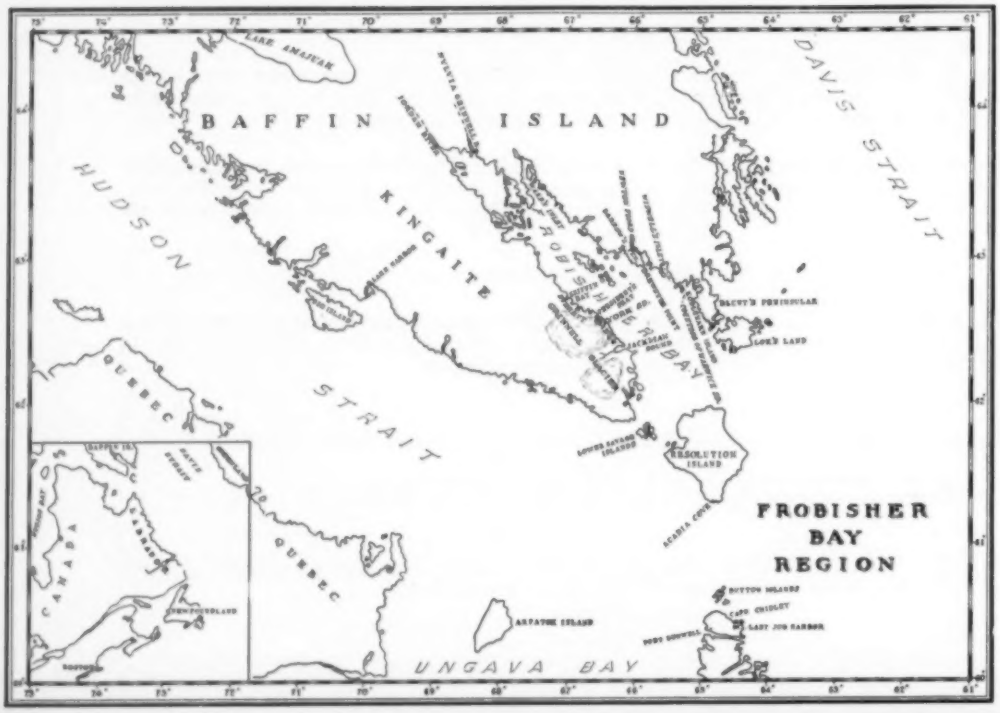
LEFT:—A complete Pitcher Plant, showing the numerous pitchers or cups, each about 5 inches long and 1¼ inches diameter, and the tall and handsome bloom.





The Eskimos of Brewster Point, north shore of Frobisher Bay, Baffin Island, come out to meet the MacMillan Expedition schooner in an old whaleboat salvaged from some arctic wreck.

THE EVERETT RANGE AND THE NORTHEASTERN PART OF THE GRINNELL ICE-CAP

The southwestern shore of Frobisher Bay rises a sheer 2,000 to 3,000 feet out of the sea to form the Everett Range, one o the most striking and picturesque shorelines in eastern North America. Its rugged topography is the result of the action of the glaciers which descend from the Grinnell Ice-Cap.

SPECTACULAR FROBISHER BAY

by **MARTIN J. BUERGER**

ITS shores afford the grandest scenery in eastern North America. Its ice-caps, the most southerly perpetual inland ice along our shores, are visibly at work fashioning cathedral-like buttresses and spires from its lofty, rocky shores. Its tides rise and fall 55 feet. Its trout approach a fisherman's dream of 2½ feet. Its shore line has risen 180 feet since the ice age.

I speak of Frobisher Bay—the long, narrow, wedge-shaped thrust which the ocean makes into the southern extremity of Baffin Island, north of Labrador. Since my visit there last summer with Lieutenant Commander Donald B. MacMillan's expedition, my enthusiasm for this little-known section has steadily increased, along with the feeling that the region—never accurately mapped—is worthy of study by geologist and cartographer. I would even recommend the bay, if you can find transportation, as an ideal destination for a summer excursion. Some details about this magnificent country may explain why.

Discovered by Martin Frobisher in 1576, the bay bearing his name was explored by him for a distance of about 130 miles into the interior of Baffin Island, under the impression that it was the much hoped for trade route to China, the famous Northwest Passage. When Frobisher returned to London to tell of his discoveries, some of the quite ordinary, black amphibolitic rock brought back by one of his crew was incorrectly identified as gold ore, and this precipitated the first gold rush into the northern New World. Headed by Frobisher, an expedition set out in each of the two following years, and both times returned laden with black rock. But before the second expedition had returned, the "ore" had already been proven worthless.

The north and east sections of Frobisher Bay were again explored in the years 1860, 1861, and 1862—this time by Charles Francis Hall. He explored the bay to its very head and thus discovered that this arm of the sea was not a through passage, as Frobisher had supposed, but rather an inclosed body of water. The place names in and about Frobisher Bay are due entirely to Frobisher and his men and to Hall, all of whom named important features after their friends or patrons.

This region has been more recently visited by several expeditions under the general leadership of Lieutenant Commander Donald B. MacMillan. The 1937 MacMillan expedition spent about a fortnight of the summer in and about Frobisher Bay. As a member of this expedition, I felt that I was continuing a Technology tradition, for Professor Alfred E. Burton and George H. Barton, '80, were with the

sixth Peary expedition to northern Greenland in the summer of 1896 and, on their way, landed at Lower Savage Islands, just south of the mouth of Frobisher Bay.

Frobisher Bay is reached by sailing along the Labrador coast to Cape Chidley, then across Hudson Strait to Resolution Island, which lies just south of the mouth of the bay. Hudson Strait is an outlet for the pack ice of the Hudson Bay region, and the pack can usually be depended upon to come pouring out of it into the North Atlantic until the latter part of July, preventing a crossing to Baffin Island until this season. The currents in the strait run from five to seven knots, gathering the ice into strings and clots of ever changing configuration and making navigation difficult. The 1937 MacMillan expedition waited six days in the vicinity of Cape Chidley for alleviation of ice conditions, finally making the crossing to Acadia Cove, Resolution Island, on July 27. Several pack clusters were penetrated during the crossing.

The tides in Frobisher Bay are so extreme that they must receive the constant attention of any expedition. At Brewster Point, on the northeast shore, a tide of 24.5 feet was measured, while in Griffin (?) Bay, somewhat farther in along the southwest shore, the tide was nearer 30 feet. Generally speaking, it can be said that the tides increase toward the head of the bay and are reputed to reach the tremendous height of 55 feet, a figure which places Frobisher Bay among the several regions of the world having very great tides. Naturally it is extremely hazardous to navigate such a body of water. Not only is it difficult to find an anchorage which is suitable both at high and low tides, but the tidal currents are very strong. This is apparent even in the deep water off Resolution Island, in the mouth of Frobisher Bay, where the sea rushes by the rock cliffs of the island in much the same manner that swift water sweeps the banks of an island in a river. The currents are even stronger within the bay itself, especially since the tide ebbs in the extremely short time of three hours or less.

All the maps and charts which show the bay are based upon the one made by Hall in the 1860's. Hall's work, of course, was of a reconnaissance nature and therefore his map is only a sketchy, inaccurate outline of the shores. Indeed, a great part of the bay, including almost the entire southwestern shore, was not actually visited by Hall, although it was tentatively sketched in by him from the opposite shore, some thirty-odd miles away. This coast is consequently indefinite, and the identification of any of its features by comparison with Hall's map is a matter of the greatest uncertainty. Needless to say, the absence of suitable charts makes navigation in Frobisher Bay still more difficult.

Although diminutive glaciers and glacierets of the mountain type occur in the mountains of northern Labrador, the most southerly point along the eastern American shore line where a true ice-cap can now be seen is on the southeastern part of Baffin Island. This region, a peninsula which is bordered by Hudson Strait to the south and by Frobisher Bay to the north, is known as Kingaite by the Frobisher Bay Eskimos. Its ice-caps ought to be well known, but are, on the contrary, unknown. Hall made his one visit to this section of the bay in order to ascend its perpetual ice in the vicinity of his Mount President's Seat. His brief description appears in his "Arctic Researches" (pages 516 to 521), but this seems to have escaped the attention of systematic glaciologists, and Hall's Grinnell Glacier is still unknown to them.

From Eskimo accounts, Hall was led to believe that his Grinnell Glacier extended about 100 miles along the southwest coast of Frobisher Bay. Last summer's reconnaissance, however, made it appear likely that this is much too generous an estimate; it probably extends only some 40 miles, or even less, along the bay. It was also discovered that this stretch of perpetual snow does not represent one ice-cap but two, between which extends a major transverse valley, filled with fluvioglacial deposits and carrying a very important river. This unnamed drainage channel, which is joined by another unnamed river only two miles inland, empties into a very large cove, tentatively identified as the Jackman Sound of the Frobisher expeditions. Near the river inlet, the freshened waters of the cove teem with gigantic trout, about 2½ feet long.

The two ice-caps are nested in radically different topography. The southeast ice-cap sends no glaciers down to the sea, and the coast topography therefore retains the rounded forms left by Baffin Island's earlier

continental ice sheet. In sharpest contrast with this is the topography fringing the northwestern ice-cap. This area of inland ice sends down numerous glaciers into the bay, and these, reinforced by cirque action, have gouged deeply into the original land surface, leaving exceedingly sharp, interglacial spurs. Hall called this fretted upland the Everett Range. It rises some 2,000 to 3,000 feet directly o f of the bay, and, capped by its mantle of perpetual ice, it constitutes a bit of the most rugged and picturesque topography in all of eastern North America. The razor sharpness of the spurs of the Everett Range is probably unsurpassed anywhere.

The present distribution and activity of inland ice in southern Baffin Island is interesting. It is confined to high land in the Kingaite region and is absent from the northeastern shore of Frobisher Bay, which attains heights of only about 1,000 feet. The ice is therefore conditioned primarily by elevation. Of the two Kingaite ice-caps, the southeastern one is located on somewhat lower ground and is also exposed on slopes of more southerly-facing tendency. It consequently wastes away by evaporating and melting rather rapidly, and does not spill over to form glaciers running down to the sea. Its northwestern neighbour, on the other hand, not only occupies higher ground but also is not exposed on southward-facing slopes. Its ice thus melts and evaporates less rapidly, and so accumulates and spills over to send glaciers down to the sea. The northerly-facing slopes of this region, largely shielded from the direct rays of the sun, also harbour snow slopes which develop cirques and small mountain galcierets much like those of northern Labrador. The President's Seat, a gigantic, armchair-shaped amphitheater, is an excellent example of this, and there are numerous other lesser ones.

No glaciers from this inland ice reach Hudson Strait water. This lack of glaciers on the southern slopes of Kingaite and the nonextension of the inland ice itself to Hudson Strait shores can probably be traced to the wasting of névé and ice in the sunlight of these directly illuminated, southward-facing slopes.

Some of the members of the MacMillan expedition spent a day in climbing one of the ice tongues back to the northwestern ice-cap. Two members (Wynne-Edwards and Edwards) climbed to the ice-cap by way of an adjacent rock spur. They found the height of one of the local, flat ice domes to be about 2,800 feet. Hall had measured the height of the ice as 3,500 feet next to the President's Seat—the highest region in Kingaite.

I was especially interested in the ice tongue itself and spent some time studying various aspects of it during the ascent to the ice-cap. This particular tongue was a relatively small one, perhaps 800 feet across and some 10 to 15 feet high where it broke off into the sea at high water. Of course, this visible height does not represent the true height of the ice front, for much of the nose of the glacier was buried in its own terminal moraine or under water. The glacier, which is about five miles long from sea to ice-cap, has sawed a slot for itself out of solid rock, leaving almost vertical walls hundreds of feet high. The talus from these steep sides is continually being removed to the sea in the form of lateral moraine.

The approach to the glacier was characterized by a milky sea, an indication of the load of rock flour which is produced by the grinding action of the ice. Out of the ice front poured a stream of water into a puddle in the terminal moraine, a picture reminiscent of the horse drinking troughs of former days. The ice front itself was very interesting. It was composed of a compact mosaic of grains averaging about walnut size but ranging up to, perhaps, two inches across. Each grain was a true, single ice crystal, proof of which was supplied by the swarms of flat air inclusions, all with flat sides parallel.

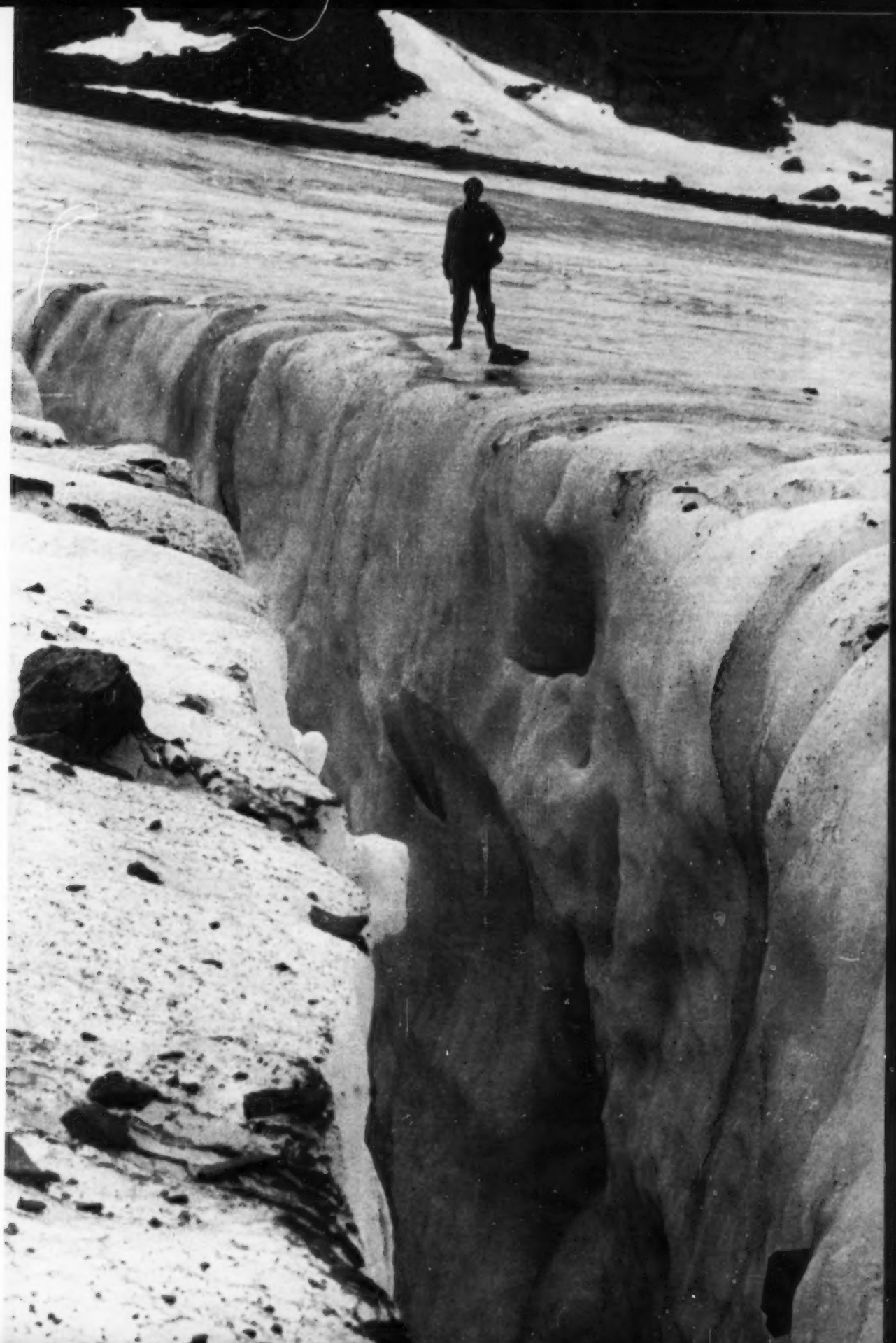
The glacier ice is strikingly coloured. In addition to the neutral ice colour, streaks and areas of the most intense but somewhat pale blue occur. Such areas probably represent healed crevasses and new ice generally. This beautiful blue tint is also found in the small icebergs formed from the local glaciers.

Much of the glacier surface is dotted with tiny rock particles, blown there from the talus piles by the strong wind. These particles absorb the sun's heat and melt the ice beneath themselves to form holes, into which they sink. The black particle at the bottom of each hole makes the hole appear to open into nothingness, and the area gives the impression of a thin crust of honey-combed, rotten ice which might crush through to an interior cavern under one's step. The footing is, of course, quite sound.

CATHEDRAL COVE

This beautiful cove, just east of Griffin Bay along the south shore of Frobisher Bay, is characterized by walls which resemble cathedral spires. The glaciers no longer descend from the Grinnell Ice-Cap into this trough. Note the high-tide marks on the rock walls and on the stranded iceberg; the tide was about 30 feet here and the picture was taken about mid-tide.

RIGHT:—A crevasse (ie., a deep ice crevice or crack) in the Grinnell Glacier. These seemingly bottomless cracks in the solid ice are due to the flowing ice tearing itself away from the ice near the valley walls where the ice movement is slower. Crevasses, when bridged by snow, constitute the greatest danger to the explorer of glaciers. One member of the party fell through one of these bridges up to his armpits, saving himself by spreading his arms. The Grinnell Glacier was an object of special study by the geological party of the MacMillan Expedition. Dr. M. J. Buerger, of the Massachusetts Institute of Technology, and geologist for the expedition, in the middle ground.



No important central crevasses occur in the tongue except where it originates as an ice stream spilling over from the ice-cap. The central crevasses here are cracks due to the sharp, downward bend in the ice at this initial drop. Below this position the ice takes on a rather uniform, steep slope, and the central crevasses close up and heal. New crevasses occur only along the sides, where diagonal tension cracks develop. These point backwards toward the center of the glacier, giving evidence that the central ice moves faster than the ice near the walls.

The MacMillan parties climbed the glacier on July 29. At this season the surface was running with water which gathered itself together into streams. These ordinarily disappeared by dropping into the side crevasses, but near the foot of the glacier, where no crevasses occurred because of lack of walls to slow down the side ice, swift streams of considerable erosive power developed and entrenched themselves in small ice valleys which were impossible to cross.

The ice-cap from which the glaciers descend is a gently domed surface whose steepest regions slope only a few hundred feet per mile. It is entirely covered with a deep mantle of granular snow. Into this, one sinks knee-deep, making travelling very tiresome. The ice itself is visible only in one or two steep, wind-swept places near the edge of the ice field, where dull, grayish ice projects from its snowy mantle. The word "wind-swept" is used advisedly, for the heavy, ice-chilled air pours down the ice tongue surface with great velocity, pushing against anyone making an ascent.

There are many indications in the Frobisher Bay region that the present ice-caps are only diminutive representatives of a great ice sheet which once not only covered Baffin Island but also extended out into the sea surrounding the land, like the present-day Ross Barrier of the antarctic regions. The northeastern shore of Frobisher Bay displays the rounded land forms characteristic of heavily glaciated regions, and many of the inlets along this shore are typical fiords. While glacial striae are uncommon, due to the rapid arctic weathering, *roches moutonnées* occur on the highest mountains, evidences of the glacial plucking which they have received. The ice came mainly from the northeasterly direction, following to a considerable extent the line of strike of the metamorphosed sedimentary rocks, but occasionally cutting across this from a more northerly direction. The ice certainly extended out beyond the land mass of Baffin Island as far as Resolution Island, which shows an extreme case of glacial plucking from the same general direction. Some 20 miles of deep sea separate Resolution Island from the Baffin Island land mass, and this gulf must have been spanned by a fringe of continental ice.

The great weight of the Pleistocene ice in Baffin Island indented the somewhat yielding crust of the earth. At the close of the Ice Age, the melting of the ice sheet and the consequent decrease of the enormous ice load permitted the land to recover slowly its normal level, and Baffin Island started to emerge from the sea, a process which added somewhat to its land area. The story of this emergence is neatly outlined on certain of the islands of Frobisher Bay. Kodlunarn Island, for example, the scene of Martin Frobisher's "gold" mining operations, has a surface marked by a succession of gravel and shingle beaches up to its very top, now 55 feet above high tide. Each of these represents a stage in the shore line of the island at an earlier period of its history. The island has certainly emerged at least 55 feet out of the sea, but this is not a measure of the total emergence of the entire area, for the island was doubtless under water during the earlier stages of the rise of the region from the sea. The river entering Jackman Sound (?) on the Kingaite side of the bay gives a better idea of the total rise. This river once meandered over an outwash plain common to the two ice-caps which it separates. The outwash plain now stands some 180 feet above high tide, and the river has entrenched its meanders nearly down to sea level. Since the river probably always emptied directly into the sea, and since it once ran over the surface of its now elevated outwash plain, this 180-foot difference between its old and new levels probably gives a good estimate of the rise of the Kingaite coast out of the sea.

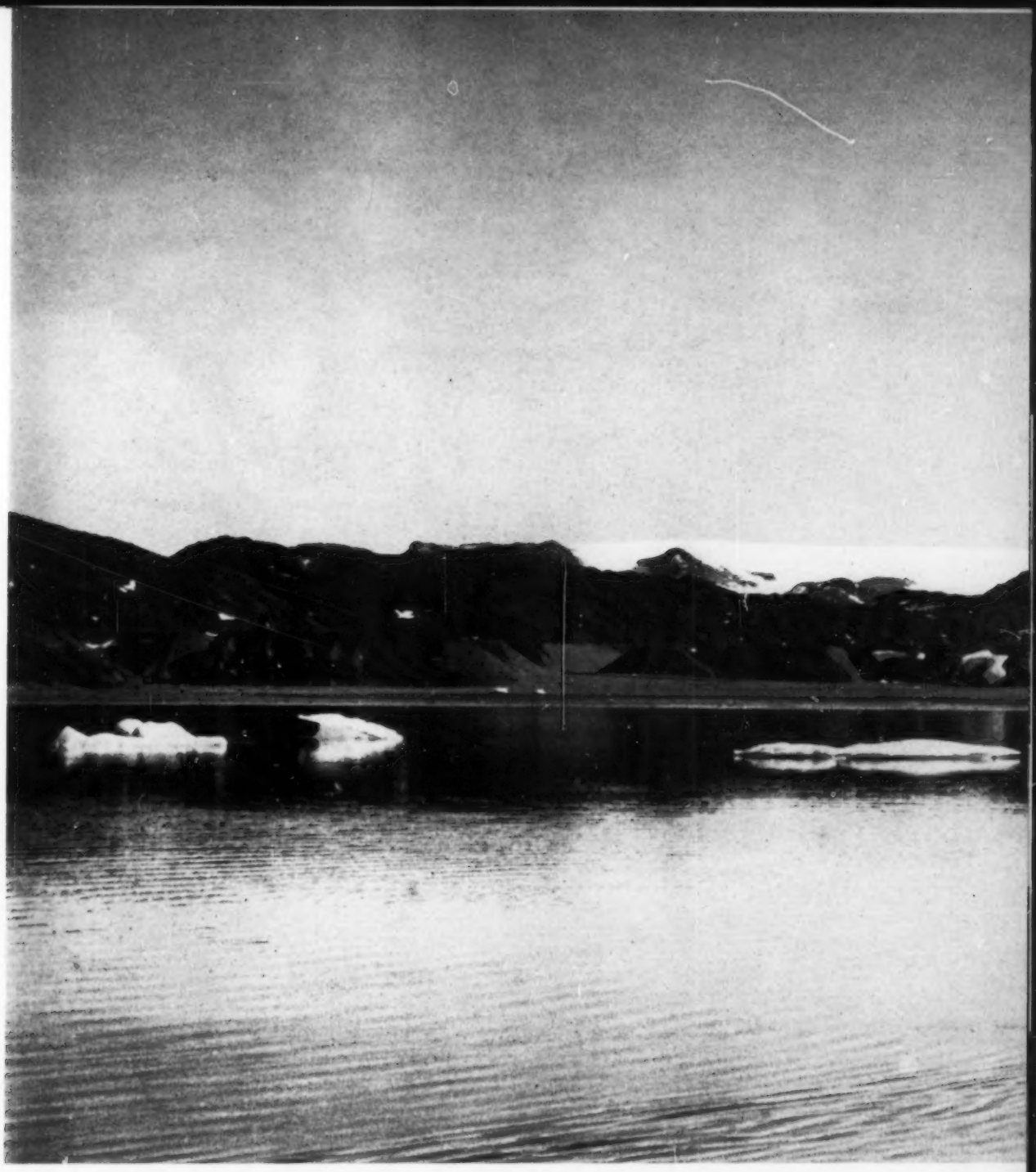
The 1937 expedition encountered no Eskimo inhabitants on the rugged Kingaite shore, although Frobisher's expedition found them in the vicinity of Jackman Sound in 1577. On the less severe northeastern coast, however, two very small settlements were found, one at Brewster Point, and the other near Wiswell's Inlet.

The Frobisher Bay Eskimos are nomads: They have no definite home but follow the seals and walruses from place to place. During the summer season they live in tents made either of sealskins sewn together or, perhaps, of canvas if they have been fortunate enough to obtain some by trading. The Brewster Point Eskimos had a couple of old whaleboats which, it was learned, were recovered from arctic wrecks. They also use the usual sealskin kayaks which have a very strong odour because they are rendered waterproof with the all-purpose seal oil.

These Eskimos, in common with other branches of their race, are incredibly dirty according to our standards. Nevertheless, the women have a sense of fashion, for they own two dickeys (the eastern equivalent of the Alaskan parkas). One of these is usually made of the Hudson's Bay Company's duffel, which is blanketing sold by the yard. This dickey becomes extremely dirty through everyday wear. The second dickey is used mainly on visiting occasions and is a work of art in sealskin. Even the Eskimo women have an eye for good furs, and the best skins—these from the ranger seals found in fresh-water inlets—are used for their dickeys. They are laboriously pieced with strips of black fur to give an inlaid effect of great beauty, the pattern of which is a characteristic of the district. In accordance with tradition, a woman's dickey is always made with a long tail. Legend has it that a polar bear once attacked a woman, mistaking her for a man, and since that time women have distinguished themselves for the benefit of the bears by wearing dickeys with tails. It is said that the bears respect this sign and confine their attentions entirely to men. The men of southern Baffin Land get along with very simple dickeys made of common sealskin far inferior in quality to that used by the women. They are without tails but have the characteristic regional peculiarity of a V-shaped slot cut out of the bottom front.

With these interesting people, with its magnificent scenery and great ice-caps, with its challenging unknowns and geologic interest, Frobisher Bay deserves both scientific exploration and sight-seeing excursions. I hope that both will be made.

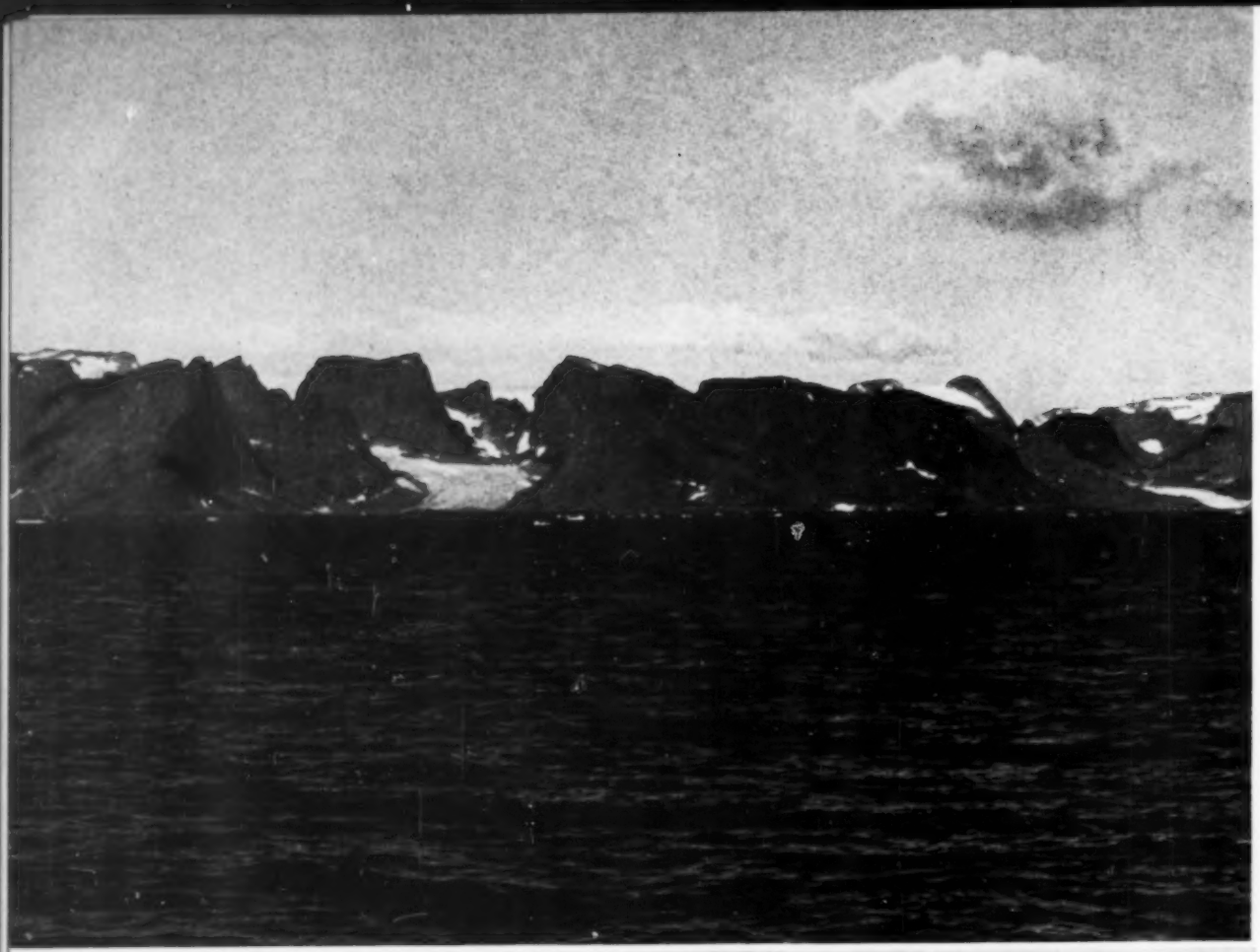
An ancient Eskimo camp site on Kodlunarn Island, north shore of Frobisher Bay, Baffin Island. In this land of rock, where tent pegs cannot be used, a ring of stones is indicative of a former Eskimo summer camp site. In this instance, the stones of the ring are covered with arctic vegetation indicative of great age.

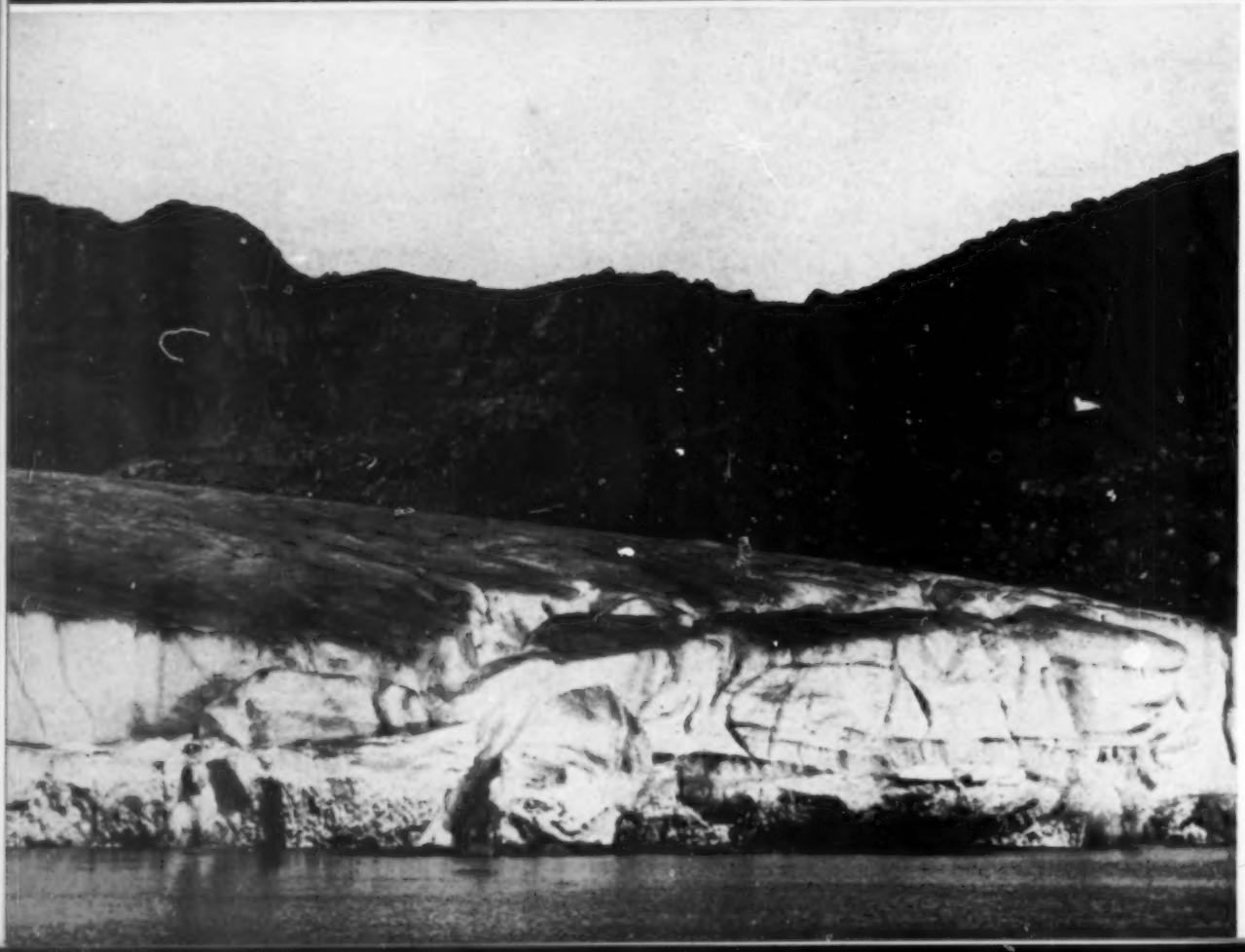


AN ANCIENT FLOOD PLAIN STRANDED BY A FALL IN SEA LEVEL

The mouth of an important transverse river whose valley divides the Grinnell Ice-Cap into two parts and which flows into the head of a prominent cove on the southwest shore of Frobisher Bay. The present river runs very rapidly through its gravelly bed, ending in a quiet lagoon behind the wavecut wall of the apron plain. The outlet of the lagoon to the cove is practically invisible. The river once meandered over the apron plain some 180 feet above the present sea level. Relieved of most of its ice load following the great ice age, Baffin Island evidently rose by at least this amount in several stages. The base-level of the river being thus lowered, it entrenched itself several times, leaving several levels of entrenched meanders in its gravel walls. The southeastern part of the Grinnell Ice-Cap is visible in the background.

LEFT:—Peter Force Sound, looking north from the high land of Barrow's Peninsula, north shore of Frobisher Bay.





THE COUNTESS OF WARWICK'S SOUND AND BLUNT'S PENINSULA

These two photographs were taken from Kodlunarn Island, scene of Martin Frobisher's "gold" - mining colony of 1577. Blunt's Peninsula, with its sharp drop into the Countess of Warwick's Sound, is in the background. The Blunt's Peninsula escarpment is evidently the wall of an enormous glacier which once occupied the Countess of Warwick's Sound. The successive beach marks in the shingle in the foreground bear evidence that Kodlunarn Island, whose top is now 55 feet above high tide, has emerged from the water in stages. Note the black block of "gold ore" left by the Frobisher expedition, to be seen in the left middle ground of the upper photograph.

A SOURCE OF ICEBERGS

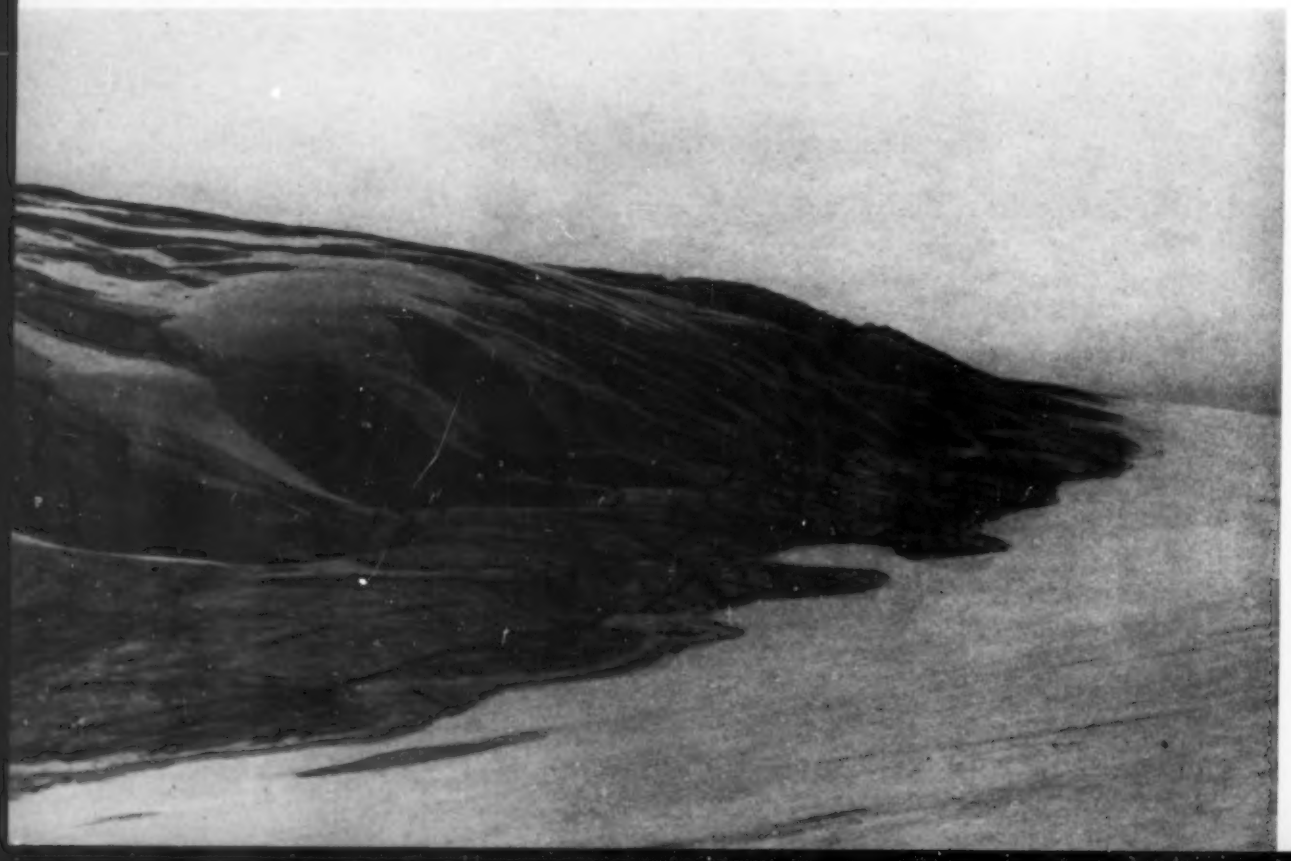
LEFT:—The Grinnell Ice-Cap Glaciers end in coves which they have scooped out for themselves. Here the edges of the glaciers break off to form rather small icebergs of beautiful bluish and greenish tints, which float off to Frobisher Bay and eventually reach the North Atlantic.

BREWSTER POINT, FROBISHER BAY, AND ITS ISLANDS

A view looking south from the southernmost of the two highest prominences (980 feet) on Barrow's Peninsula, Frobisher Bay. The islands trend in the direction of the prevailing strike of the metamorphic rocks, and are separated, for the most part, by relatively deep channels. The Gertrude Thebaud, MacMillan Expedition schooner, at anchor in the left middle ground.

THE ICE OF THE GRINNELL ICE-CAP PROJECTING OUT FROM UNDER ITS MANTLE OF SNOW

At this point a tongue of ice of the Grinnell Ice-Cap bends over the edge of the plateau-like highland and starts its way down to sea as a glacier.



When the tongue of a glacier flows relentlessly down to sea, the moving ice plucks and tears the rock away from the bottoms of the valley walls with which it is in contact. Having thus created voids, the ice flows into them and plucks out more rock. In this way a glacier scours its way and produces a valley with vertical walls, as shown in the photograph.

The Grinnell Glacier reaches the sea, a solid mass of flowing ice. This tongue, which was chosen for special study by the MacMillan Expedition, extends backwards along a winding course to the main ice-cap, some five miles away and almost 3,000 feet high.

A typical Frobisher Bay Eskimo family.
encampment near Wiswell's Inlet, north

ABOVE:—

A group of two photographs of the women of the Brewster Point Eskimo encampment. The woman's "dickey" differs from the man's by having a short apron in front, which is used as a kind of hand covering or muff, and also by having a long tail (see Eskimo encampment photograph) behind. The purpose of the latter is to distinguished the women from the men for the benefit of the polar bear, who, so legend has it, will never attack a woman so distinguished.

The top of the woman's "dickey" is made wide to accommodate the Eskimo baby, who rides on his mother's bare back for warmth. The infant is either naked, or, as in the present case, has a small "dickey" of his own, but no pants.

The women have acquired cloth skirts through trading. The original native costume is sealskin "shorts."

RIGHT:—A Brewster Point Eskimo kayak. This graceful watercraft, which resembles the American sportsman's duck-hunting boat, is ingeniously constructed of a patchwork of raw sealskin stretched on a driftwood frame. It is kept waterproof by dosing with seal oil. It can be propelled very rapidly and an Eskimo can keep up with an ordinary power boat making ten miles an hour without great difficulty.

The kayak ordinarily carries the Eskimo's instruments of chase, including harpoon and killing lance. In this case its major tool, on the right, is a kind of boathook used for recovering sunken seals and walrus shot in shallow water.

One of two tents constituting an Eskimo shore of Frobisher Bay, Baffin Island.

ABOVE:—The Brewster Point Eskimo encampment. The Baffin Island Eskimos are nomads and move from place to place to follow the best hunting, mainly seal, walrus, and caribou. The Brewster Point encampment consisted of three patched canvas tents (obtained by trading) when the MacMillan Expedition schooner arrived, and this was increased by one sealskin tent shortly after, with the arrival of another family. Since the ground is solid rock with a thin carpet of vegetation, tent pegs cannot be used and the canopy is held in position by a ring of stones. Such rings mark old Eskimo camp sites. It is not generally appreciated that Eskimos live in tents "tupik" in the summer. They only use snow houses "iglu" in the winter when snow is available.

AT TOP:—A study in Eskimo types: The Brewster Point Eskimo men are reciprocating by studying the scientists of the MacMillan Expedition. The hooded jackets, known loosely to white men as "dickeys" (a corruption of the Eskimo atiga), are ordinarily made of raw, uncured sealskin which smells strongly. In the case of the white "dickey," the material is bulk Hudson's Bay Company blanketing, known as "duffel," and obtained by trading. The men's "dickeys" are usually distinguished by a triangular piece cut out of the front bottom as shown in the boy's sealskin garment, second from the left. The women's "dickeys" have a characteristic cut of their own and are shown in another photograph.

LEFT:—A Brewster Point Eskimo grave. It is no easy matter to bury a body in Baffin Island because there isn't any soil, properly speaking, and even if there were, it would be too solidly frozen to dig except in the summer. The Eskimos get around this by piling rocks over the corpse in such a way that the rock arches over the body but does not touch it. This preserves the body against wild animals. Any popular Eskimo camp site has plenty of these graves, for they last forever. The driftwood cross on this grave shows a remote missionary influence. A mummified body is visible through the chinks in the stones.

ORCHIDS OF THE GATINEAU VALLEY

Photos by Hands Studios, Ottawa

by **H. E. M. KENSIT**

ABOUT twenty-seven miles north of Ottawa, near the village of Alcove, on the Gatineau River, lies a little-known and surprisingly wooded swamp that is carpeted in summer with beautiful orchids, pitcher and other water-loving plants. It is quite a scene when you reach it. Lying well back from the road and therefore seldom visited, it is approached across the fields of a farm, —then on a well-defined line you come suddenly to the edge of the thickly forested swamp. Penetrate but a little way—you will need rubber boots and anti-mosquito cream to do it with any comfort — and you are surrounded by a thick growth of cedar, tamarack, spruce and other trees, largely covered with lichen moss hanging in long festoons, the whole possessing a dark and dismal appearance. The surface is largely water-logged peat, covered by a deep bed of moss, through which project long wiry grass, reeds and numerous plants. The general appearance strongly reminds the writer of the cypress swamps in central Florida. In the depth of the swamp on a summer day, surrounded by orchids and other flowers, and in an atmosphere closely resembling a Turkish bath, one has an uncanny feeling — can this be possible in a country as far north as Canada ?

This unusual and fascinating spot lies entirely on private property. The first settler was Mr. Samuel Chilcott, grandfather of the present owner, an Englishman who came to Canada as a young man about 1833. He acquired some 200 acres of unbroken but fine farming land from the government at a nominal price, this including the water rights on the portion of a large lake bordering the property, such rights going with the land at that time. Those were pioneer days. This pioneer had little money and no horse, and it is recorded that he had to walk the thirty or so miles from Ottawa to the new homestead, where he proceeded to build a log house. To hasten getting on the land, he even left some of the stumps of the trees within the area of the house to serve as seats. History relates that this Mr. Chilcott was a lay preacher as well as a farmer, and that, not content with the work of building a log house and barns and bringing a large tract of wild land under cultivation, he filled up his spare time by walking the round trip of some twenty-five miles from his homestead to Cascades on Sundays to conduct a church service. However, no better example could be found of the fruits of continuous enterprise and industry than at this spot in the lovely Gatineau Valley. The original property has been considerably added to, and the present owner, Mr. Stanley Samuel Chilcott, can survey from his large and modern house one of the most beautiful, well-kept and productive farms that can be seen anywhere. The Chilcotts, with this long history, are naturally prominent in the neighborhood, and it should be noted that the lake bordering on their property, marked on the maps as Lake Johnston, is known throughout the district as Chilcott's Lake, and the extensive swamp which is referred to herein as the home of the orchids and pitcher plants, as Chilcott's swamp.

We should at this point make clear the differences between the orchids of the tropics and those of more northern latitudes. In the tropical regions orchids are air or epiphytal plants, attaching themselves to the trunks or branches of trees or to rocks and obtaining their nourishment from the roots sent out to and hanging in the air. In temperate regions, however, nearly all orchids become terrestrial in habit, and form roots, sometimes bulbous, which draw their sustenance directly from the soil and water, mostly in swamps and marshes. Those in Canada are of the latter class.

LEFT:—A bunch of the Showy Lady's Slipper, that brings out well the grace and beauty of the blooms and the nature of the leaves.

Orchids constitute an enormous family, variously estimated to contain from 5,000 to 12,000 species, this being largely caused by their natural facility for cross-breeding. There is therefore plenty of room for a wide variety of forms, from those that are of great beauty to some that are grotesque in appearance and some which are quite plain.

In the warmer climates they range from plants so minute as to be almost invisible, to shrubs, and to vines which grow to a height of 40 feet. Only two species out of the vast number yield any commercial product. One of the epiphytal type, the Vanilla, yields the well known essence, and another of the terrestrial type known as the *Aplectrum hyemale* or "putty-root," yields a viscous liquid from its tuberous roots that is used to cement earthenware.

But we want to describe those of Quebec. The valley of the Gatineau River is so famous for its beauty, for the variety and charm of its scenery, that there is no need to enlarge on that, and the unspoilt village of Alcove is one of the most attractive of the many small towns and villages scattered along the river. We will start our exploration from that point. We turn northeast from the main road through Alcove at the church, and proceed about three miles to the village of Lascelles, turn left and then right up the road with signpost marked "Lake Bernard." About a mile beyond this there comes into view, first the swamp and a corner of Lake Johnston on which it borders, and then the large white Chilcott house facing the road, which there takes a sharp turn. A portion of the swamp is indicated on the map by hatching, and the flowers we have mentioned are most plentiful about the centre of this, directly opposite the Chilcott house. Along the edge of the swamp runs a very small creek—across this at a certain point there commences an almost indistinguishable trail which leads right to the spot. The orchids are the most numerous, the pitcher plants are scattered amongst them, and both appear to be most abundant where the cedars are thickest and the ground the most spongy.

LEFT:—A map of the route to the swamp, the hatching on the border of Lake Johnston in the upper left hand corner showing a portion of the swamp and about centreing on the spot where the orchids and pitcher plants are abundant.

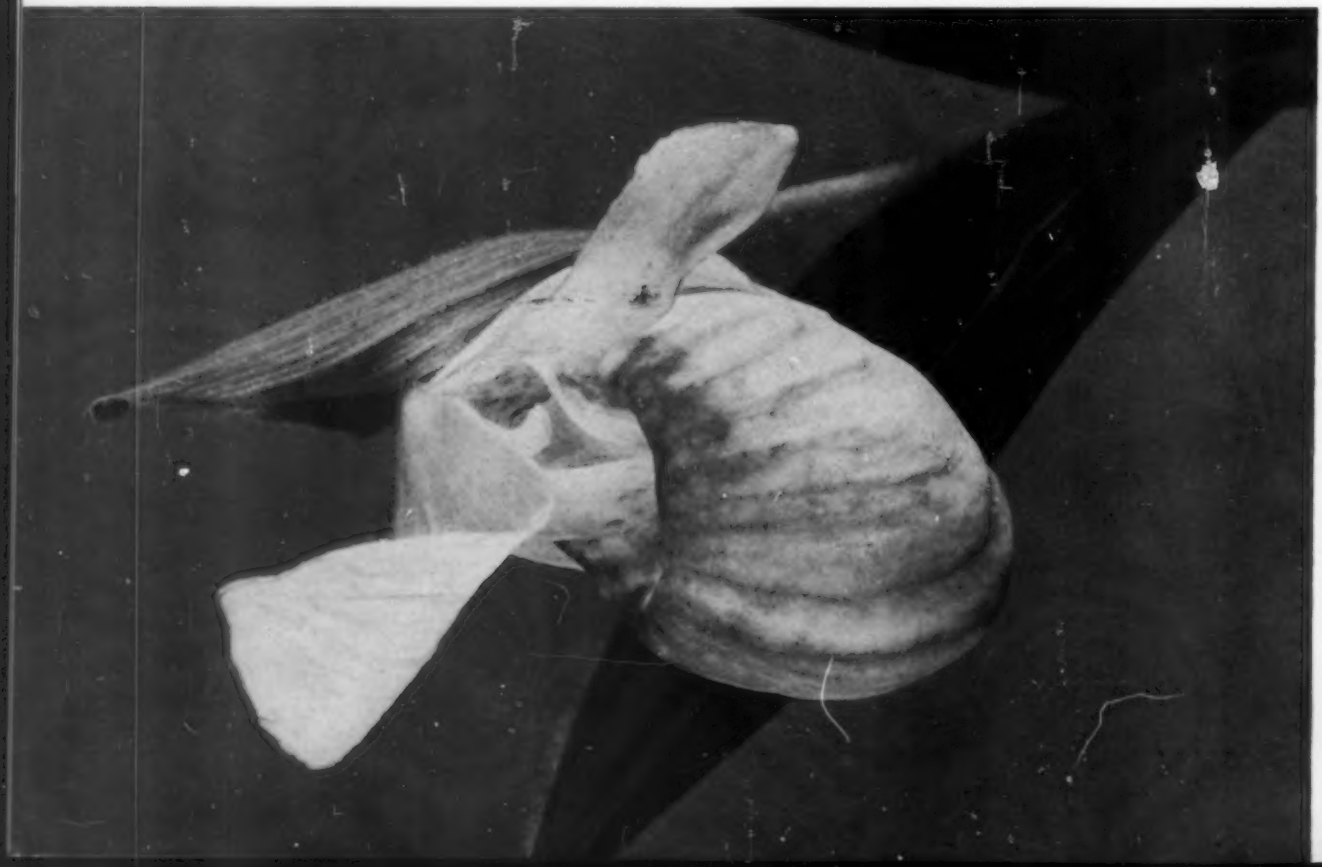
RIGHT:—A corner in the swamp, showing a tamarack tree in the centre, with lichen moss hanging in long streamers, and some of the characteristic plants in the foreground.

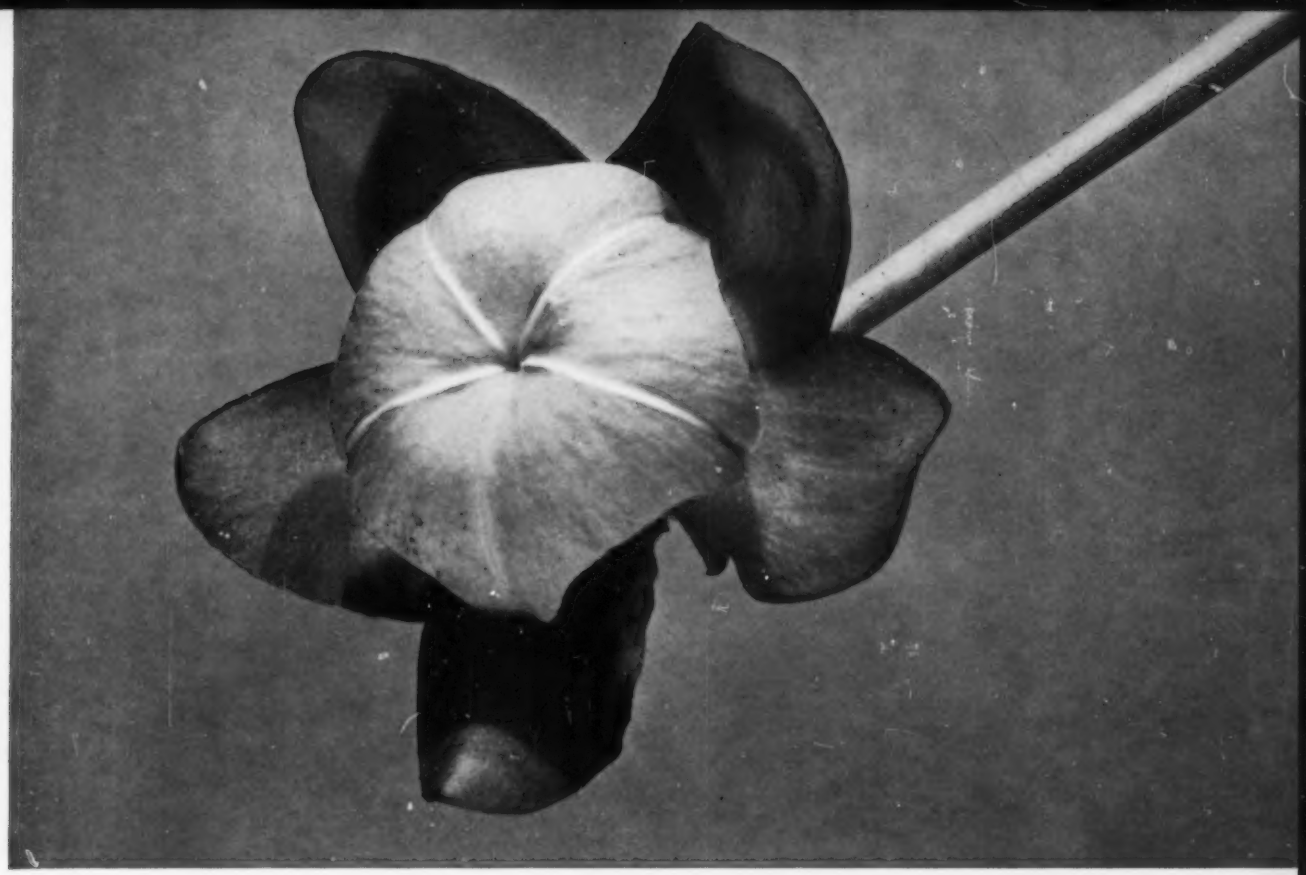
The most plentiful of the orchids is the "Showy Lady's Slipper" (*Cyprepedium Hirsutum*), a delicate and beautiful bloom on a stem ten or twelve inches high, white with pink shading of varied intensity and pink stripes inside the cup. These were present in thousands over a considerable area, sometimes singly, sometimes in large groups or beds, all growing through several inches of sphagnum moss, and in standing water with masses of long thin roots. A very similar but less abundant orchid that is also present is the Yellow Lady's Slipper (*Cypripedium Parsiflorum*). The Pitcher Plants (*Sarracenia Purpurea*) are fairly numerous — they form strong spreading plants, the cups or pitchers arranged round the centre and the whole forming a plant up to about ten inches across, embedded in the sphagnum moss. The bloom of the Pitcher Plant is remarkable in appearance, standing on a stem 15 to 18 inches high. From around this stem radiate petals, a deep reddish purple on their under surface and bright green on the upper surface, curving upwards. From the large globular centre of the flower rises a short and sturdy stem that carries an inverted rosette which suggests an umbrella, the points curving inwards on a shorter radius toward the lower petals. The whole of the under surface is therefore purple and the whole of the upper surface a pale green. A reference from this description to the "close-up" photo of the bloom should make the appearance fairly clear. The leaves or pitchers themselves are worthy of a little description. They are strong and "leathery" with a flaring lip, about five inches long and one and one quarter inches in diameter, so that they collect and hold quite a lot of water. The inside is covered with stiff glandular hairs forming a sweet secretion and pointing downwards to trap insects, which are decomposed in the water and absorbed by the plant. A few insects, notably the species of mosquito named ÆDES, can survive, and this lays its eggs in the water in the pitcher, where they mature and eventually fly out fully capable of making a nuisance of themselves. Lastly, as a crowning touch, scattered all through this wealth of vegetation and flowers, are abundant strawberries, large and luscious, growing five or six on a single stem. You pick a stem, straighten up, and eat the berries one by one.

Judging from three visits, the Showy Lady's Slipper and the Pitcher Plants appear to be in full bloom between the 8th and 16th of July and the Yellow Lady's Slipper is said to precede this by a week or ten days. Certainly if any one desires to see an unusual sight that can be easily accomplished from the Capital City in a day, this swamp would be hard to beat.

A view of the north end of the swamp, taken from the Chilcott's farm, showing a corner of Lake Johnston.

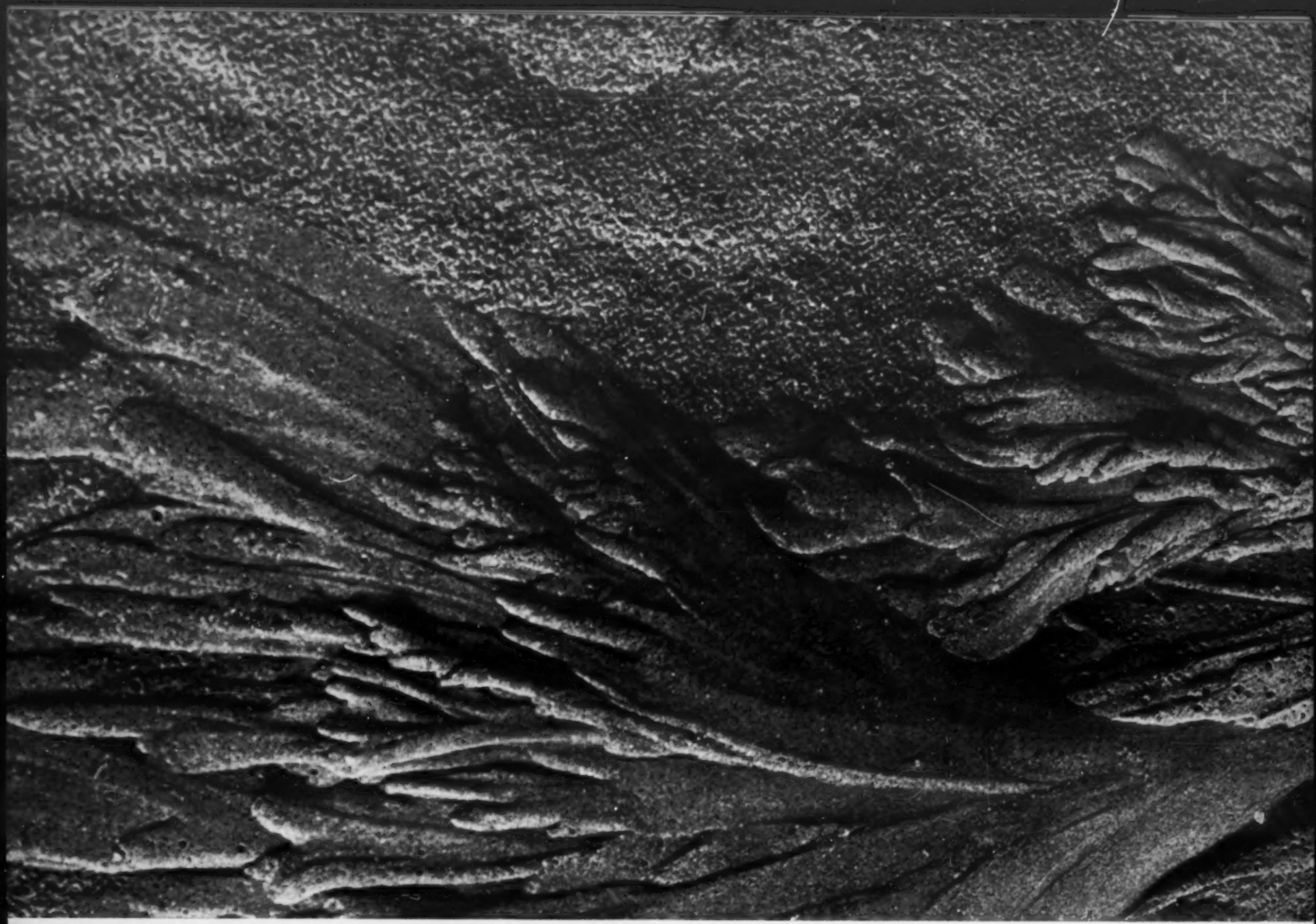
An enlarged close up of the Showy Lady's Slipper (Cypripedium Hirsutum), a true orchid, indicating the delicate pink shading on a pure white ground. The depth of this pink colour varies considerably in different blooms.

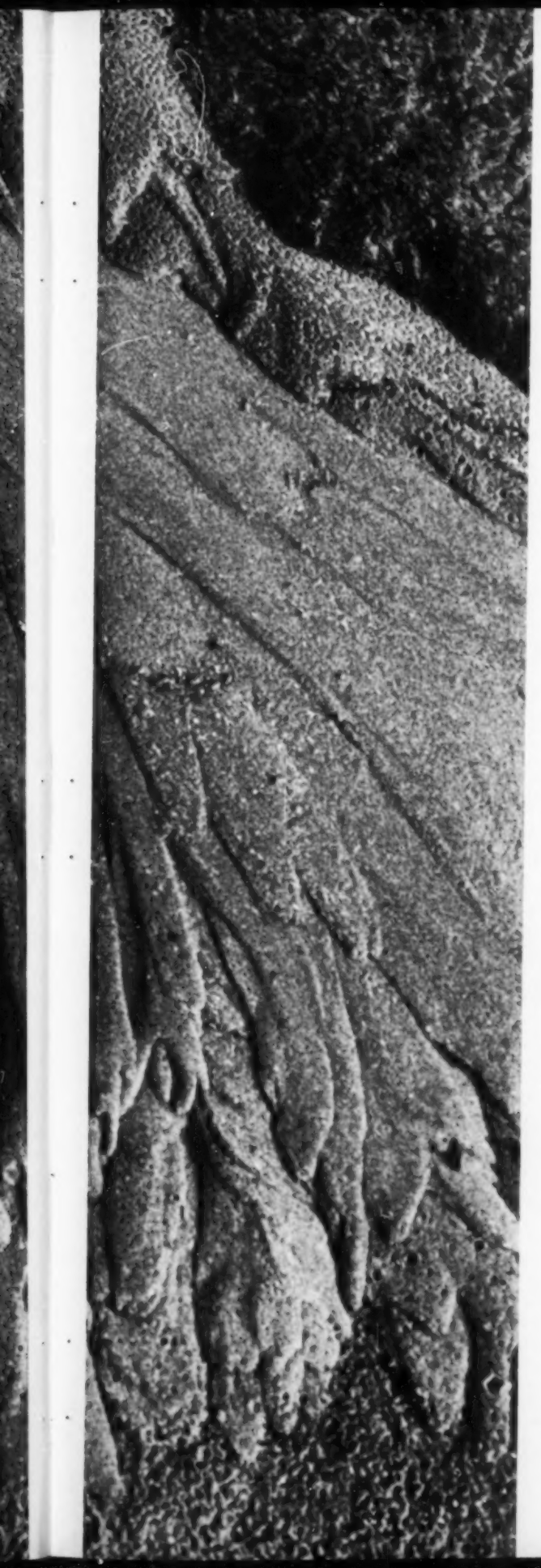




A close up front view of the Pitcher Plant bloom, slightly enlarged, carried on a stem 15 to 18 inches long. The back is a deep red purple with a burnished appearance, the face or front all pale green.

A group of the Showy Lady's Slipper and Pitcher Plants as they grow in the swamp surrounded by deep beds of moss.





*Tidal Effects Upon The Ocean Floor

by **ALFRED EHRHARDT**

*Translated from the German by Helen Cowie, with revision by D. A. Nichols, Physical Geographer, Department of Mines and Resources, Ottawa.

THE rotation of the earth, and the effect of the sun and moon on our planet greatly influence the earth's surface. The attraction of the sun and moon are real forces, which cause for example the ebb and flow of the tides. Twice a day the great seas send enormous masses of water in the form of a gigantic wave to the coasts of the continents. This is the flow. For about six hours these powerful masses of water roll in upon the land, and for about six hours they roll back. A never-ending game of alternation on the part of mother earth, whose mind we scarcely understand. Out at sea one can observe this game only slightly, as there is no measure by means of which a layman can recognize the rise and fall of the water. This alternation is more noticeable along the coasts of the ocean. Here, in places, arise differences up to 10 meters between the water level of the height of the ebb and that of the flow tide. On steep coasts, as for example along the south of England, the rise and fall of the water level can be observed very well. Much more interesting, however, is the alternation of the tides along lowlying coasts, such as those between the estuaries of the Elbe and Weser on the North Sea. At the ebb tide, broad flat stretches of sea bottom are free from water. Ground, which for six hours was sea bottom, is freed, and for six hours belongs to the mainland. Moreover, it is not only a question of small but also of

LEFT:—Fine dry sand, mingled with the water of the tide or of the rain begins to "run" and assumes these leaf-like shapes.

wide areas which stretch out into the sea for 30 kilometers. This remarkable intertidal area, which every six hours belongs alternately to the sea and to the mainland is called "Watt" or "Watternmeer." It is a strange realm between land and sea, a sort of no-man's land, continually being fought over and belonging alternately to one and then to the other. On account of this great "ebb" and "flow" it is possible for us on the coast of the mainland to study closely and by daylight a certain section of the sea bottom. Scientifically it is one of the most interesting districts, in that one can examine the formations of this section of the earth's surface and so ascertain how the powerful forces of the current of the sea mould the land forms of our earth. This is important, not only because we can catch a glimpse of the process of moulding done by the sea, but rather more because we can, from the formations of many strata of the continents of to-day make certain 'a posteriori' conclusions concerning the seas of previous ages. Indeed one can confirm exactly by the formation of the "Flats" how much water has stood above the sea bottom, how powerful the currents and undulations of the sea were, whether the water has been stirred by the wind in strong or weak undulations, the direction of the wind, its strength, and other phenomena.

There are to be found in the "Flats" formations of the soil that are not only of highest significance scientifically, but also from the aesthetic point of view are real wonders of nature. Here, the elementary forces reveal what a high artistic instinct nature possesses. Here, far from all civilization are to be found formations of primitive character.

One will probably wonder why this highly interesting district, the "Watt" has

The powerful breakers of the big storms wrench away soft pieces of the bottom and the firm parts remain as "islands." The undulation of the surface of the sand is very similar to the undulation of the surface of the water.

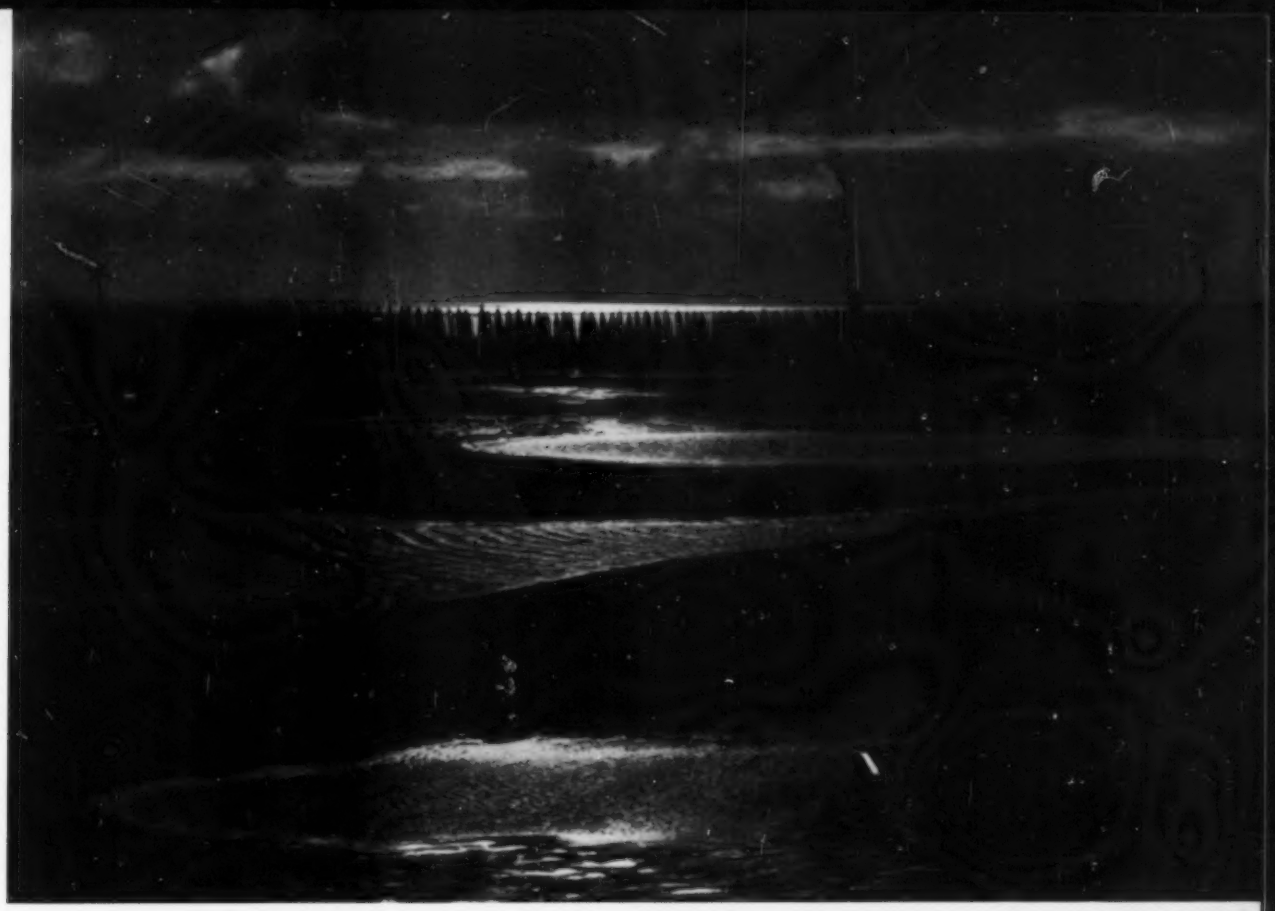
not long since been studied scientifically or appraised aesthetically. The explanation is that the "Watt" is a mysterious district, full of danger, uninhabited by man, without vegetation — endless, bare flat surfaces. The ground consists of sand, partly hard and smooth, but there are wide districts which are muddy and soft, in which one will sink up to one's knees. On such ground, naturally progress is very slow; the tide, however, comes in rapidly with great regularity and punctuality. If one does not return to the mainland at the right time, one must drown in the oncoming tide. But on dry land too one must be exceedingly careful. If one ventures out too far and the flow tide begins, one cannot escape even by running, for the incoming tide has a speed of 80 kilometers an hour. Mechanical aids to escape, such as motor cars and aeroplanes cannot be employed. The cars would sink in the uncertain soft ground and aeroplanes could not land. Most dangerous, however, is the "Mahlsand," sand mixed with water, into which one quickly sinks deeply, and from which one cannot extricate oneself. Boats which become stranded on the "Mahlsand" quickly sink down into this sandy graveyard. In many spots the "Mahlsand" reaches a depth of 250 meters; here too, could the largest ocean going vessel find a sandy grave. A further danger is the sea fog which approaches suddenly, making it impossible to find one's bearings. It compels men to wander in circles until the flow tide comes and ends this despairing wandering.

The sea currents have excavated deep channels, comparable to a gradiose planned system of canals. These primeval streams sometimes 1,000 and 2,000 meters broad and frequently from 7 to 12 meters deep, are called "Priele." The immense masses

The shore of a big "Priele." One can easily recognize from the contours in the foreground, how the masses of water which covered the now open "Watt" during the flood tide, have streamed into the broad drainage channel of the "Priele."

The steep edge, about two meters in height, of an emptied "Priele."

A large river in the "Flats," called "Priele." It has a breadth of about 1,000 meters and a depth of 9 meters. The dark point of the sandy peninsula is a mussel bank.



A "Stak", a sort of breakwater, to protect the shore of the dry land. When the "Watt" is covered with water, boats also travel here. As a warning to deep water craft the two slanting crosses are put on the "Stak".

The source of a "Priele," which is like the source of a river in that the water sinks in the ground, but is forced out by the pressure of the approaching tide.

of flood tide water are conducted to the "Watt" through these "Priele," and, through the "Watt" streams flow the waters, overflowing the "Watt" at the time of the flow tide and returning back again to the open sea. A main stream of this kind has many tributaries, which again divide into smaller streams. Thus grows a "Priele" system, a network of rivers as it were.

It is with difficulty that one can extricate oneself from such a district when one has been lost therein. Even the most powerful swimmers could not possibly swim across the large "Priele" for the current in the middle is so strong that one cannot get out of it. The "Priele" districts of the "Watt" are the most beautiful and also the most dangerous. The river beds are being daily dug. There, twice a day terraces are being built in the river beds, just as they were formed on the continents during thousands of years.

It is on account of the dangers that this district, unendingly interesting from a geographical, geological and artistic point of view has, up to the present, remained so completely unknown. Only those who have studied for years the ground and weather conditions of this peculiar part of the earth and have lived in the district are familiar enough with the dangers to escape from them in safety. The uninitiated are continually coming to see the "Watt" but they never return. No year passes that the "Watt" between the Elbe and Weser does not demand a toll of from 20 to 30 lives.

The reason why the "Watt" has been closed up to the present to photography is that the big photographic and film cameras were too heavy and cumbersome to be transported to the "Watt." However, the development of the small camera in the

Part of the shore of a "Priele." The ripple marks are made by the current of the ebbing water.

last ten years has made it possible to open up the district to the photographer. In the last three years I have taken some 500 photographs. Also I have observed the effect of the sea currents, of the wind-stirred surface of the water and its part in the formation of the sea bottom, of the ripples and big ridges in the sand and their evolution as part of the landscape of the "Watt," which is built up out of sand by wave formation. In the pictures, the movements of the masses of water, and their work on the bottom are captured; in addition the little and big "Priele" currents, the very interesting "Priele" shore, the different substances forming the bottom, in their present form; the incoming tide, and other features.

In the "Watt" there are many incidents of movement to be found, e.g. the eternally flowing water of the "Priele;" the wind and its effect in formations, the incoming tide and finally the effect of the full surging power of the sea. These movements I photographed last summer, and produced a film of this wonderful district.

By the means of this photographic and film work, the "Watt" for the first time has been available for pictures. From this it is evident that there are on this earth to-day certain regions which show us quite distinctly what this earth looked like in the gray dawn of time when some of the strata were being deposited, for in the "Watt" region the same processes are moulding the coasts of that area as were operating in the early days of the earth's creation.

The rivers of the "Watt" are called "Priele". The picture shows the bed of a little "Priele".

Streams leading to the main stream of a large "Priele," caused by the receding ebb tide.

The tide comes in. The water first moves slowly over the dry "Watt", later the speed of the approaching water increases to 80 kilometers an hour. The water rolling up pushes ahead of it a broad run of foam. The particles of foam have collected into little islands and float as remarkable shapeless mounds on the furthest edge of the incoming tidal water.

A tributary "Priele", emptying into a main "Priele". One can recognize easily in the river bed of this "Priele" the familiar terraces which are to be seen in dry land streams.

"Fossil mud" gathers at a steep spot in the "Watt". The fine particles of mud are washed over the sandy bottom by the tide and are caught up by a "Mudbank" (left).

ABOVE:—Eastern Arctic Patrol on board, R.M.S. "Nascopie" at Fort Ross, N.W.T.

CENTER:—Eskimo woman stretching seal skin to dry.

BELOW:—Start of Kayak race, Port Burwell, N.W.T.

THE ANNUAL EASTERN ARCTIC PATROL

by **D. L. McKEAND**

FOR sixteen years Canada's annual Eastern Arctic Patrol has carried the benefits and advantages of British Sovereignty to a vast hinterland of 999,680 square miles, peopled by 6,768 white and Eskimo citizens. Although the Eastern Arctic had been prominent in the fur trade since the seventeenth century, it was not until the inauguration of the annual Eastern Arctic Patrol by the Canadian Government in 1922 that the occupation and administration of Canada's Arctic outposts became a reality. Since that time the story of the annual Patrol has been one of steady progress in the patrolling, policing, care of the natives, and scientific investigation of the region by the co-operation of the different government departments whose activities touch on northern affairs.

Eskimos in holiday attire for annual visit, Eastern Arctic Patrol.

Experience has made possible the covering of more territory each year. The scope and influence of the Eastern Arctic Patrol has been extended despite the fact that some of the ports-of-call are accessible only for a period of ten days or two weeks each year. The distance travelled by the Patrol has been increased from 7,000 miles in 1922 to 10,860 miles in 1937. Since 1922 four ships have been used to carry the government expedition on its annual trip to the North. The C.G.S. "Arctic" carried the Patrol from 1922 to 1925; the S.S. "Beothic" was used from 1926 to 1931; in 1932 the S.S. "Ungava" made the trip; and the R.M.S. "Nascopie" has been used since 1933. Whereas the "Arctic" made only five calls in 1922, the "Nascopie" made twenty-four and carried supplies and mail for forty-three trading posts in 1937. In addition, members of the scientific divisions and Royal Canadian Mounted Police with the expedition last year made extensive voyages on other vessels, totalling 3,825 miles.

The main function of the Eastern Arctic Patrol is the supervision of the health and well-being of the Eskimos. The yearly visit of the Patrol is the occasion of an annual gathering of the natives for miles around to meet the ship, and at every port of call the Medical Officer of the Patrol is enabled to conduct a health examination. Largely as a result of these annual inspections, resident medical officers have been established at strategic points.

Today full time medical officers and nurses are maintained at Chesterfield and Pangnirtung, and at each of these points is a modern hospital with electric lights and central heating. While these institutions are owned and operated by the Roman Catholic and Anglican missionaries, respectively, the Northwest Territories Administration makes a per diem allowance for each patient treated and also provides transportation for fuel supplies. In 1937 the first industrial home in the Northwest Territories for the care of the aged, infirm and incurables was opened by the Roman Catholic missionaries at Chesterfield.

The provision of medical service for the natives, together with education in personal hygiene and sanitation has brought about a decided improvement in the general health of the Eskimo population. A striking success has been the progress made in the correction of methods of feeding infants and elder children, with the result that happy-faced vigorous children now form a considerable portion of the steadily increasing native population.

At each port of call the scientific division of the Patrol is afforded every opportunity to conduct its respective

lines of investigation. Extensive collections of rocks and fossils are made each year, and important advances have been made in the study of the general geology and geography of the region. Soundings to determine the upper limits of marine submergence have been conducted over a period of years, and astronomic and magnetic stations established. In addition, biologists, ichthyologists, botanists, and other scientists have gathered a wealth of scientific and other information relative to native and wild life.

No part of the Arctic is too remote to be served by British justice, and an important phase of the annual expedition is the transferring of Royal Canadian Mounted Police to and from their Arctic stations. Police posts are strategically located to permit of connecting patrols by land and water so that all the inhabited parts of both the Eastern and Western Arctic are adequately covered and law and order maintained. On the first Patrol in 1922 the Royal Canadian Mounted Police established a detachment and opened the post office at Craig Harbour on Ellesmere Island, 830 miles from the North Pole. In the following year, 1923, a complete Court of Justice was taken north by the Patrol to sit on a murder case at Pond Inlet. To establish the Bache Peninsula detachment of the Royal Canadian Mounted Police, 760 miles from the North Pole, the Eastern Arctic Patrol made its farthest trip north in 1926.

In the field of scientific research, each successive Patrol sees the exploration of new avenues leading to increased knowledge of Canada's Far North. For instance, high lights of the 1937 Patrol were the maintenance of direct radio communication with Ottawa during the entire voyage, the holding of a two-way radiotelephone conversation between the Officer in Charge of the Patrol and officials of the Department of Mines and Resources at Ottawa. An event of historical significance during the 1937 expedition was the meeting and exchange of cargo in the eastern end of Bellot Strait between the "Nascopie" and the M/S "Aklavik" from Cambridge Bay in the Western Arctic.

The achievements of the annual Eastern Arctic Patrol cannot be attributed to any one individual or group, but are the results of several successive expeditions and a careful study of the vast library of Arctic literature dealing with the search for the Northwest Passage. Modern means of navigation and communication have done much to aid the Canadian Government in carrying out administrative operations, but the most important factor in maintaining British Sovereignty in the Eastern Arctic is the understanding and friendly relationship which exists between the Administration, fur traders, missionaries and the Eskimos.

Royal Canadian Mounted Police Post, Lake Harbour, Baffin Island, N.W.T.

Hauling white whale hides, Pangnirtung, Baffin Island, N.W.T.

Eskimos spearing Arctic char in fish trap, Boothia Peninsula, the most northerly tip of the mainland in North America.

SAVING THE WORLD'S RAREST ANIMAL

Photos by the author.

by **E. K. PATTERSON**

THE most enchanting little animal that ever lived — that is a tribute which scores of visitors to Australia have paid to Australia's famous "Teddy Bear"— the koala. The rarest in the world, the koala is a friendly, inoffensive little fur-bearer, which has been rendered almost extinct by the activities of fur-hunters. In many parts of Australia efforts are now being made to save the bear; several bear farms have been established, and the animal is now closely protected by law. Invaluable as a subject for research work in certain human diseases, the koala is a major attraction for tourists and a charming advertisement for Australia, and its extinction would be a national loss.

The koala is not a real bear, although superficially it resembles one. It is actually an arboreal marsupial, and is the only animal of its kind in the world, being the sole member of its genus. It is the only marsupial without a tail, and grows to an average length of about two feet, its body being covered with very thick and soft woolly fur, ranging from light grey to dark grey in colour. It has a large black "naked" nose, short rounded ears, and lovely dark eyes.

The animal's food consists solely of fresh young gum-tree leaves, without which it cannot exist. This diet necessitates vast quantities of leaves being eaten in order that the animal may receive sufficient carbohydrates, protein, and fat, and Nature has responded to such demands by providing the animal with an amazing appendix —larger than that of any other animal in existence.

The koala is an excellent climber, having powerful limbs and sharp, strong claws; it is able to ascend to the uppermost branches of the tallest trees with amazing rapidity, and even on the ground can attain a considerable speed. It feeds chiefly at night, spending most of the daylight hours sleeping, cosily seated or curled up in a low fork of a tree.

The koala lacks a voice in harmony with its charming appearance and ways. It utters hoarse discordant cries, which are in some respects like the grunt of an annoyed pig. The animal breeds during the early winter months (from June to August), and gives birth to only one baby at a time. The baby is born in the usual way, but in a very immature condition, being only about an inch long. Immediately after birth the mother transfers it to her pouch, where the baby's mouth closes over a teat, which swells, holding the baby in the pouch.

The baby is carried in the pouch until it is about six months old, and for the next two months or so it is carried on its mother's back until it is able to fend for itself.

Only in recent years have Australians realized that the koala is infinitely more valuable alive than dead. Up till the beginning of the present century the forests of Eastern Australia literally teemed with the animals, which were so plentiful that it was virtually impossible to walk a mile anywhere through the bush without seeing dozens of them on the ground and in the gum trees. But then someone discovered that the skins of the bears made warm rugs and overcoats, and from that time onward the koala faced extinction. The skins proved more and more popular; there was an increasing demand for them in all parts of the world, not only for making into rugs and overcoats, but also for turning out natural and life-like Teddy Bears for children in all countries.

Thus, professional hunters in thousands set out after the koalas. The bear was pursued relentlessly. Countless millions were slaughtered until they were practically exterminated, and then, because of their scarcity, hunting them became unprofitable. They are now the rarest animals in the world. In many parts of Australia they are totally extinct as wild animals; they are now no longer seen in the open

LEFT:—The Koalas, with their sharp strong claws are excellent climbers, being able to ascend to the uppermost branches of the tallest trees with amazing rapidity. The large black "naked" nose, short rounded ears, and lovely dark eyes of the marsupials are also clearly indicated.

bush, except in remote and almost inaccessible mountain gorges where the remnants of thriving communities live in seclusion, and are gradually dying out. In addition to their many enemies, such as dingoes and eagles, the bears are subject to a mysterious disease—a kind of influenza or pneumonia—from which they rarely recover.

Only permanent and strict protection can save this wonderful animal, and in an effort to partly restore the bear population, several koala farms have been established, where the animals are being bred in semi-captivity and distributed to sanctuaries throughout the country. The oldest and largest of these farms is situated on the outskirts of the city of Brisbane, Queensland. This farm has been visited by thousands of tourists from all parts of the world, including Royalty, and from it bears have been distributed to government sanctuaries and forest reserves, and to public and private zoos in all parts of Australia.

The export of the animals from Australia is rigidly prohibited; but this prohibition is hardly necessary, because it is doubtful whether a koala could be taken alive to another country owing to the exclusive nature of its diet. Without fresh young gum-tree leaves it cannot exist for any length of time. In an emergency it will take other food, but all strange food only hastens its death.

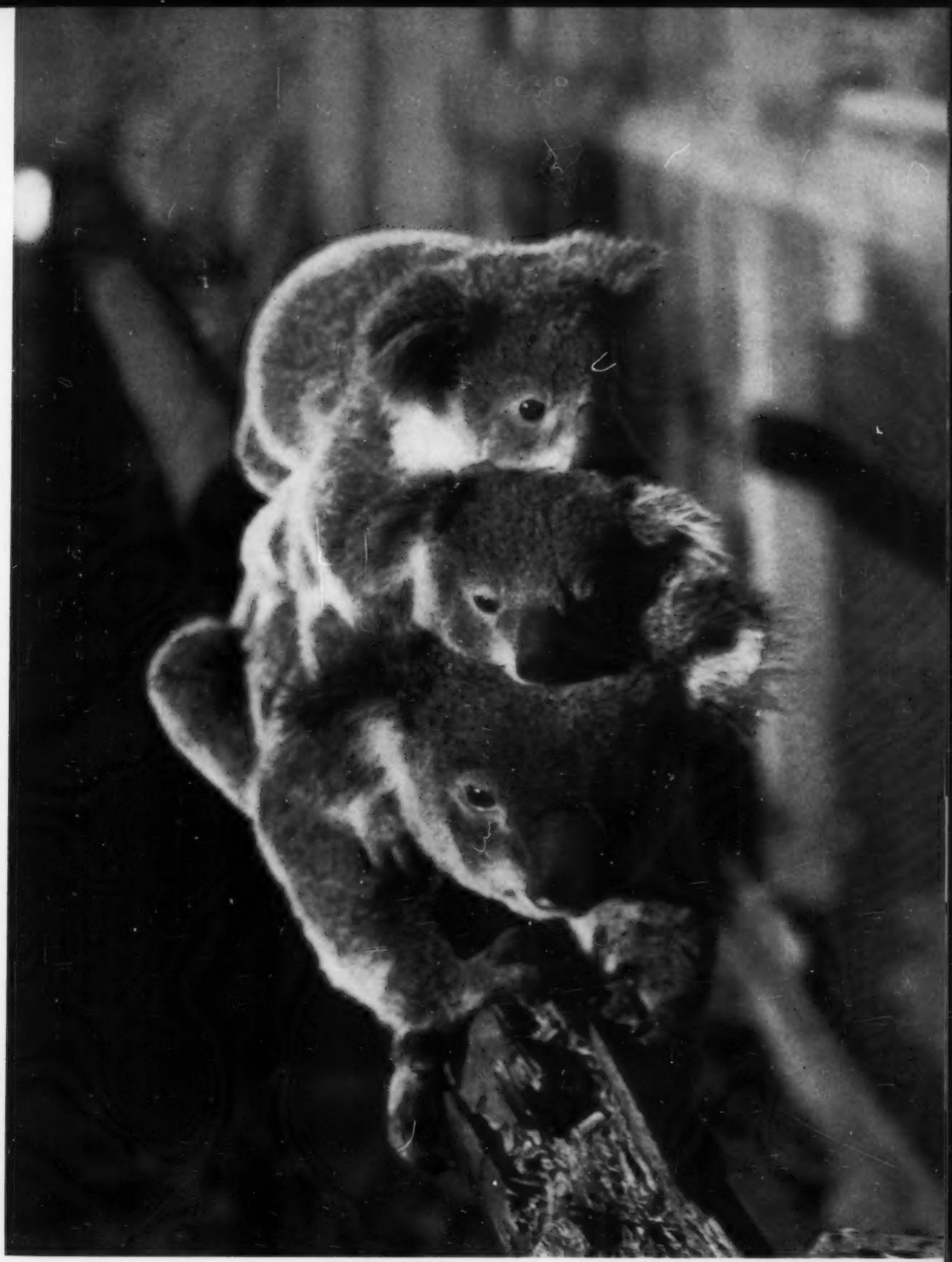
Farming the koala entails considerable work. Every day fresh supplies of young gum-leaves have to be obtained for the animals, and to collect this food journeys of hundreds of miles into the bush are often necessary. The bear farmers, however, do not have to worry about water. Much has been written about the ability of the camel to do without a drink for a considerable period. But the koala is much more remarkable in this respect, for invariably it goes right through life without a drink of any kind! The bear is unique among all animals in that it does not naturally drink; in fact, it cannot drink—when offered water it always tries to chew the liquid as it chews leaves! The animal is completely satisfied with the small amount of moisture it obtains from the gum-leaves it eats.

The koala is of absorbing scientific interest. Sir Colin Mackenzie, the Director of the Australian Institute of Anatomy, has said that "the lessons which may be learned by the comparative anatomist from this unique little survivor from a past age are many, as will be seen by a study of its various systems in comparison with those of man." Of all animals none is more fruitful for investigation and observation than the koala. In the case of lungs the bear throws light on the development of the human type, while the animal also has a gall-bladder, which is interesting because there is none in the horse, or other vegetarian animals.

Directions in which the koala has already been of special value to medical science are in the treatment of infantile paralysis through a study of its musculature, and in the design of splints for the upper limbs. During the Great War also, study of the koala's anatomy was of immense value in evolving a technique to restore the use of shattered limbs and in recovering the use of muscles. The koala is the only animal which, like man, possesses the power of raising the arms at a right angle from the body and above the head.

The koala is a relic of a bygone age. It was a monster in prehistoric times; fossilized remains that have been discovered in various parts of Australia within recent times reveal the interesting fact that the koala's ancestors of thousands of years ago weighed about a quarter of a ton, with a bulk about twenty-eight times as great as that of the present bears.

A koala being fed at the Sir Colin Mackenzie Sanctuary, at Healesville, in the State of Victoria, Australia. The marsupial is being fed with fresh young gum-tree leaves — its sole food. Without these leaves the bear cannot exist for any length of time. In an emergency it will take other food, but all strange food only hastens its death. Gum-trees, plentiful throughout Australia, are evergreens, and consequently at all times of the year there is a plentiful supply of leaves.



A mother koala (native bear) and her family. The koala breeds during the early winter months, from June to August, and gives birth to only one baby at a time. Immediately after birth the baby is transferred by the mother to her pouch where the young one's mouth closes over a teat, which swells, holding the baby in the pouch. The baby is carried in the pouch until it is about six months old, and for the next two months or so it is carried on its mother's back until it is able to fend for itself. The bear in the picture is carrying two of her growing children, which were born in successive years.

LAKE SHORE GOLD MINE

by **M. C. GILBERT**

LAKE Shore gold mine enjoys the distinction of being the largest gold producer on the North American continent and is the sixth largest in the world although there are twenty-five others that treat larger tonnages of ore. Last year its output was valued at $15,000,000 and its total value of production since the start of milling operations in 1918 is approximately $140,510,000. Dividends in 1937 were $12,000,000 bringing the total dividend payments to date up to approximately $65,000,000. Ore is being mined from depths as great as 4,000 feet and the daily tonnage hoisted is over 2,400 tons. The mine has over 60 miles of underground workings including levels and drifts. At present the Company employs over 1,650 men, has an annual payroll of $2,850,000 and expends for supplies and equipment an additional $2,500,000. From the foregoing it will be seen how important is the contribution of this one mine to the economic life of the Dominion.

And yet the early history of Lake Shore is the old story of the triumph of dogged persistence and optimism over discouragement and Nature's obstacles.

Situated almost in the centre of what is now known as the Kirkland Lake belt and close to the town of Kirkland Lake, which is 398 miles by rail northeast of Toronto, Lake Shore mine lies within the area of Precambrian rock which recent developments have shown to be one of Nature's great store houses of mineral wealth.

The area of Precambrian rocks or as it is sometimes called the Canadian Shield includes almost all of the province of Quebec north of St. Lawrence River, two-thirds or more of the province of Ontario, a large part of Manitoba, parts of northern Saskatchewan and Alberta and most of the Northwest Territories. It thus extends roughly in the form of an immense "U" from the Labrador coast on the east, skirting around Hudson Bay westward almost to the mouth of Mackenzie River. The whole area is characterized by countless lakes, both large and small, muskegs,

LEFT:—Night view of Lake Shore Mine.

and numerous branching streams and rivers that occupy the valleys between hummocky hills. For the most part south of James Bay the country is densely wooded, the principal trees being spruce, balsam, fir, poplar, and pine.

From the Shield has come all the gold produced in Ontario and Manitoba. About 45 per cent of the total Canadian output of gold has been derived from the Shield and about 86 per cent of the present annual production is from that source. The greatest known concentration of gold at present is in the Porcupine-Kirkland Lake Belt of Ontario.

Porcupine was discovered in 1909 largely as an overflow of prospectors from Cobalt. It seems strange that gold was not discovered around Kirkland Lake until 1912 as the area lies midway between Cobalt and Porcupine although slightly to the east. Gold was discovered at Swastika as early as 1905 and Kirkland Lake is only five miles east of that point. Morever there was a prospecting rush into that Larder Lake area in 1906 and Larder Lake is almost due east of Kirkland Lake!

Whatever delayed discovery in Kirkland Lake the fact remains that the first discovery of gold in that area did not take place until late in 1911 almost two years after the finding of Porcupine.

Early in January, 1912, Harry Oakes and the Tough Brothers staked the Tough-Oakes property; and shortly after Oakes moved a short distance westward and staked the Oakes claims on the shores of Kirkland Lake. These claims were later to become Lake Shore mine, now the richest gold mine on the American Continent. The story of Harry Oakes and the Lake Shore mine is one of the great romances of mining and it is perhaps the only mine on record in which the original staker retained control throughout the history of development. Oakes himself financed the preliminary work and laboured with pick and shovel at his exploration shaft as hard as any of his men. But he had courage and faith. W. H. Wright, another prospector, put his money into it, and capital for building a small mill was raised by selling stock at around 30 cents a share. The Great War was on — Wright was in France doing his bit as a private — and money was hard to raise. But Oakes held on. Finally in 1918 his faith was rewarded for early in that year a cross-cut run under the waters of Kirkland Lake from the shore of the lake struck the so-called North Vein. This is the main "break" of the Kirkland Lake area and is characterized by ore shoots of great length, good widths, and spectacular grade. Its discovery spelled success for Oakes and his associates for from this date, Lake Shore with few temporary set-backs began to make strides towards its present position.

The productive veins of the Kirkland Lake district lie within a belt of sedimentary rocks that occupy a trough or depression in the older Keewatin rocks. This trough is comparatively narrow — at Kirkland Lake it is approximately two miles wide — but it extends across the country for over 100 miles.

In the vicinity of Kirkland Lake the older sedimentary rocks have been invaded by tongues or offshoots of igneous rocks of granitic type in the form of dykes and large dome-shaped masses known as bosses.

On the Lake Shore property a large mass of this igneous rock known as syenite porphyry extends from about the centre of the property eastward for a distance of one and a half miles. Many dykes of the same material extend westward from the boss and it is in this area that the best ore shoots have been found — widths up to seventy feet of high grade ore having been opened up. It is evident that the intrusion of the porphyry mass caused intense fracturing of the sedimentary rocks and it is along these fractures that the gold-bearing solutions were later deposited.

The strongest zone of fracturing in Lake Shore mine is the North or No. 2 vein which extends across the property a distance of 2,800 feet and in places is more than 100 feet in width. About 400 feet south of this vein is the South or No. 1 vein. This vein has been opened up westward from the shafts for a distance of 1,500 feet. East from the shaft the vein continues for about 900 feet where it is faulted and enters the Wright-Hargreaves property. On the whole the ore-shoots on this vein are less continuous and narrower than on the No. 2 vein. Running between the two main veins are a number of small diagonal veins, which, although relatively unimportant at present give promise of providing considerable ore with gold at its present value.

The mine has been developed by two vertical shafts, No. 1 and No. 3 with levels

Load of timber after leaving impregnator. Mine timbers are treated with chemical solution to prolong the life of the timber underground.

Timber yard in foreground showing No. 3 shaft in the distance. The mine provides a large market for Canadian timber.

at intervals of 200 feet down to 2,200 feet, and at intervals of 125 feet below this depth. Cross cuts join the two shafts at the different levels down to the bottom of No. 3 shaft. Opening into the cross-cuts are the ore passes and also the sand passes that supply the fill for the mined-out stopes. These passes run from the surface to the 4,450 level.

No. 1 is a three-compartment shaft reaching to a depth of 4,500 feet in two stages, the first to 2,200 feet, the second offset at the 2,000-foot level where the hoist is located. No. 3, the main shaft, handles all supplies and men, and is the principal ore-hoisting shaft. It extends to a depth of 4,000 feet in a single stage. The compartment for hoisting the men is 6 feet x 12 feet and in addition to the manway compartment are two compartments for hoisting the ore, each 5 feet, 7 inches x 5 feet 6 inches. The overall dimensions of the shaft are approximately 17 feet x 14 feet. Across the lake from the main mine building is No. 2, an inclined shaft extending down to the 200-foot level which is used for handling timber and similar supplies. The use of this shaft makes possible the storage of inflammable material away from the main plant.

A new shaft known as No. 5 shaft has been recently completed down to the 4,075-foot level and will eventually replace No. 3 shaft as the main hoisting shaft. Its outside dimensions are the same as No. 3 shaft, but the use of steel instead of timber will allow for slightly larger hoisting compartments. A novel feature is the use of Haydite panels for lining the sets thus making the shaft completely fireproof. Haydite is a material specially prepared from certain clays, its use as an aggregate in concrete instead of sand or clay makes possible the construction of durable light-weight slabs. The collar of No. 5 shaft is in the bed of the lake now filled with tailings from the mill. The problem of reaching bed rock through about 70 feet of loose material presented a somewhat difficult problem. It was solved by sinking a circular caisson of reinforced concrete having an outside diameter of 40 feet and inside diameter of 28 feet. The height of the finished caisson is 66 feet and the total weight is 4,071 tons.

Actual mining is carried on by the cut-and-fill method. In this type of mining a slice of the ore is broken down from the top. It is then mucked into the ore chutes. The place of the broken ore is filled in with sand or waste to a height that allows the miner to set up his drills and break down another slice of ore. For this method considerable timber is required to support the walls and backs of the stope and to afford protection for the workmen. This method of mining minimizes dilution of the ore from waste rock and also permits of selective mining. Drilling is done by compressed air, detachable bits being used to overcome the disadvantage of handling great lengths of drill steel from great depths.

The ore from each level is drawn in cars to the ore pass in the main cross-cuts by means of storage battery locomotives. Each motor is equipped with two batteries the spare one being charged, while the other is in use. There is a charging station on each level. Huge jaw crushers on the 1,400-foot, 2,000-foot, 2,700 and 3,825-foot levels crush the ore to 5½ inches. Passes meeting below each crusher deliver the ore to the leading pockets from whence it is hoisted almost a mile to the surface in skips holding, in the case of No. 3 shaft, 6 tons, and 4 tons in No. 1. At No. 3 the skips dump into a circular steel storage bin of 540 tons capacity from which it is transferred by a 30-inch belt conveyor to the bin at the head of the surface crushing plant. Approximately 2,500 tons of ore is hoisted every working day.

For the purpose of filling the places from which the ore has been stoped, sand which is obtained from pits eight miles away, is dumped into the sand pass system. From this the sand may be delivered to any level as required. Waste rock from development work is also used for this purpose. In 1937 approximately 450,000 tons of material for backfill was placed in the stopes.

Ventilation is an important item in mining at depths such as the Lake Shore is at present. Natural ventilation is supplemented by two blowers on the 4,450 and 1,000-foot levels; having capacities of 42,000 and 50,000 cubic feet per minute at pressures of 2½ and 4 inches respectively.

Every precaution against accidents is taken. As an incentive to preventing accidents shift bosses are given bonuses for lack of accidents to the men under their supervision. Conversely, a penalty

RIGHT:—Forging drill steel in the steel room. This is the only mine in Canada using detachable drill heads.

is exacted for each accident involving loss of time. Courses in First-Aid are periodically given and it is the endeavour of the management that all workmen be familiar with the safety rules and to have all the men competent in First-Aid requirements.

Gold Recovery

Because of the complex nature of the Lake Shore ore considerable difficulty was experienced, more especially in the early years of operation, in developing a treatment method suitable for the efficient recovery of the gold. The metal occurs in the ores in the native state, as gold tellurides, and as finely divided gold in sulphides, particularly in pyrite, a sulphide of iron.

For several years it was thought that the presence of tellurides was responsible for the high loss of gold in the tailings. Later it was determined, as a result of tests and research work, that this loss was due largely to the finely divided association of the gold in the pyrite. It became a case then of grinding the ores to a fineness comparable to that of talcum powder to free this gold, having due regard at the same time to an economic limit of grinding. The net result has been that, whereas formerly only between 80 and 85 per cent of the gold content of the ore was being recovered, the present recovery is in excess of 96 per cent.

Although modifications are being made in the treatment process from time to

Construction of new No. 5 shaft on the 800-foot level showing steel frame work and lining of Haydite panels; main man cage compartment; centre manway, pipe and cable compartment; tandem skip-cage compartment, 14′ x 18′. The new shaft which is completely fireproof, is now in operation down to a depth of 4,075 feet.

time, the gold in the Lake Shore ore is now being recovered by what is known as the straight cyanide process, with certain technical control to accelerate the breaking up of the gold tellurides.

As was noted, the ore is crushed to an average diameter of 10 microns in the underground crushers, from where it is conveyed to seven 460-ton bins. It is at this point that milling commences. The ore from the bins passes first to a series of ball mills to which water is added to form a wet pulp mixture. Here it is further reduced in size, and it is at this stage also that the cyanide solution is first added.

The discharge from the ball mills passes to the classifiers, where the oversize material settles to the bottom, and by mechanical devices is returned to the ball mill circuit for further grinding. The action of the classifiers is such that the fine particles are carried to the top where they overflow into a series of tube mills, somewhat similar in appearance to ball mills, but capable or grinding the ore much finer.

By this time close to 70 per cent of recoverable gold in the ore has been dissolved in the cyanide solution. The grinding of the ore is completed in the tube mills, which like the ball mills, and for the same purpose, operate in closed circuit with the classifiers. The overflow from the classifiers passes in turn through a series of primary and secondary agitators. Here the pulp is thoroughly mixed with the cyanide solution for periods up to forty-eight hours, to dissolve the remainder of the gold.

The next step in the process is the removal of the finely divided ore from which the gold has been dissolved. This is done by successively passing the solution through a series of thickners and filter pressess. The worthless pulp is scraped off the leaves of the filters, and is discarded to the tailings dump, and the gold-bearing solution, now called pregnant solution, is sent to a vacuum tank to remove dissolved air. Next a small amount of finely powdered black zinc is added from the bottom of a small hopper. The zinc has the property of precipitating the gold as a black-looking sludge from its solution.

This sludge, and the gold cyanide solution are pumped to filter presses. When the solution is forced through the presses the clear barren cyanide solution is pumped back to the mill to be used again. After some days' run the presses are opened and the black gold precipitate containing some zinc, silver, lead and a little copper is scraped off the filter canvasses and falls to the bottom of the presses. Here it is caught in cars running on rails and is sent to the refinery, where it is melted with the addition of certain materials known as fluxes.

The molten gold now has its well known yellow colour, and is cast into bars or ingots of varying degrees of purity. The bars are now boxed and shipped to the Royal Canadian Mint at Ottawa for the final refining.

It is a far cry from the rock-like ore of the mine to the shining gold in the bars that are the symbols not only of wealth, but also of the triumph of man's skill and ingenuity over the obstacles of Nature.

Dumping sand for back fill from sand train into sand pass which feeds down to the lowest mine levels. Each year hundreds of thousands of tons are used to fill in worked-out stopes.

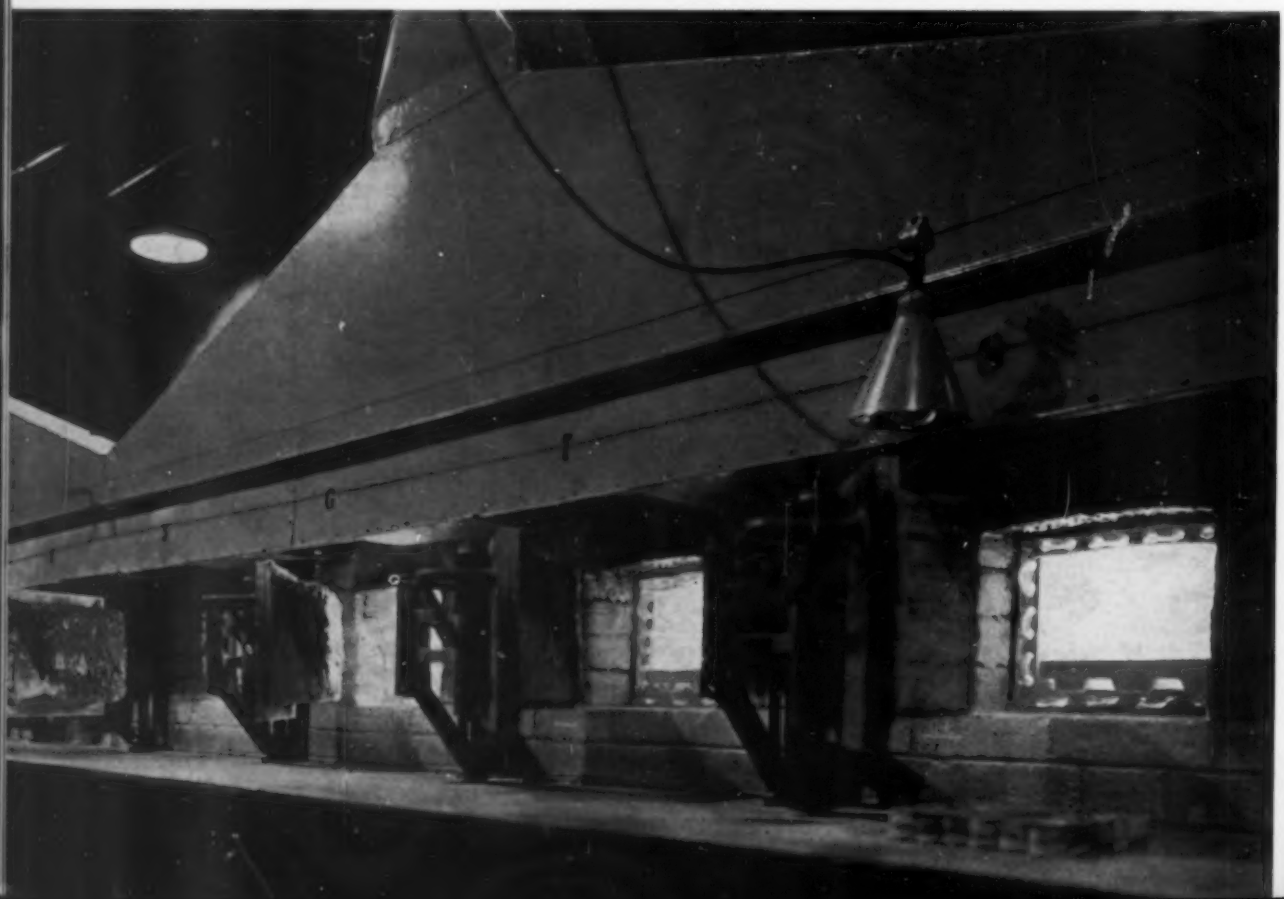
Locomotive battery being charged on the 2,950-foot level. The average life of the battery is approximately 42 months continuous service.

Ball and chain control loading chute on the 2,950-foot level. Ore fills a six ton skip.

Placing newly charged battery into locomotive by means of special lifting device (used battery on bench to right). Approximately 25 storage battery locomotives are used for underground haulage.

Part of the new assay office; operator pouring molten charge into moulds. Thousands of assays are made daily to determine the grade of ore being mined and the recovery of gold in the mill.

Four of a battery of eight furnaces in new assay office.



Lake Shore Mill: crushed ore storage bins showing belt distributor (above rear).

Weighing bead of gold in assay room — part of continuous operation to determine gold content of ore. These balances weigh to several thousandths of an ounce.

The start of No. 5 shaft by the caisson method. The shaft passed through seventy feet of slime reaching the rock. This is the first time in Canada that a shaft has been sunk by this method.

Dumping sand from a sand train into the sand pass. From the sand pass it is distributed throughout the whole mine for back filling.

To Continue Mine Transportation Assistance

An allocation of $1,300,000 has been provided, to be spent mainly on the construction and improvement of roads into remote mining areas where transportation costs are so high as to retard development. Present arrangements, which are subject to revision, call for the expenditure by the Dominion Government during the current fiscal year of $25,000 in Nova Scotia; $250,000 in Quebec; $250,000 in Ontario; $225,000 in Manitoba; $125,000 in Saskatchewan; $50,000 in Alberta; $240,000 in British Columbia; and,a total of $93,000 in Yukon and the Northwest Territories. Under the scheme, agreements are made with the Provinces concerned whereby the work is to be carried out under the direction of the Provincial Government, with the understanding that two-thirds of the total expenditure in each case will be contributed by the Dominion Government and one-third by the respective provinces. All projects are subject to the final approval of the Department of Mines and Resources, Ottawa, which also finances and carries out all work undertaken in the Yukon and Northwest Territories.

EDITOR'S NOTE BOOK

M. J. Buerger who writes on "Spectacular Frobisher Bay" in this issue is Associate Professor of Minerology and Crystallography at the Massachusetts Institute of Technology, Cambridge. Following several years on exploration work in Newfoundland he accompanied the MacMillan Baffinland Expedition in 1937 as geologist. Some observations made during the course of that trip, particularly with reference to the comparatively unknown ice-caps, form the basis of his article.

H. E. M. Kensit, known to readers of the Journal for his contributions dealing with engineering subjects makes an interesting departure in this issue in writing on his observations in the field of botany in "Orchids of the Gatineau Valley." Of particular interest to the people of Canada's capital city, Ottawa, the article may well stimulate local exploration.

Ewen K. Patterson who writes on "Saving The World's Rarest Animal" was born in "Sunny Queensland" and having always lived in Australia is well qualified to write on the subject. He has written numerous articles on conditions in Australia, various phases of life, industry, etc. for leading newspapers and periodicals throughout the British Empire.

AMONGST THE NEW BOOKS

Roumanian Journey, by SACHEVERELL SITWELL (London: Batsford, 1938, 8/6). Any book by one of the three famous Sitwells is bound to be interesting. When the subject is a country comparatively unknown and the author a poet and prose writer of distinction, one embarks with him upon his journey with pleasurable anticipation. He tells us he refrained from "reading up" on Roumania and entered it with little more knowledge of what he was to see than the average man's idea that it is a country of many oil wells, of gay peasant costumes, and Bucarest, Queen Marie, and King Carol. But Mr. Sitwell has travelled widely in most other countries of Europe and possesses an intimate knowledge of their art and architecture. With this rich background for comparison, and the encouragement and hospitality accorded him by Roumanian friends his journey was full of charm, and fresh and exciting experiences.

The book is dedicated to Princess Anne-Marie Callimacki at whose instigation it was written. Her hospitality, her comprehensive knowledge and love of her country was supplemented by the sound learning of her husband and other distinguished Roumanians, who saw to it that Mr. Sitwell was given every opportunity to see and understand the various phases of their national life and interpret it to the outside world.

He found much to reward him; a country of strong individuality, of great scenic beauty, picturesque and hospitable inhabitants, and such characteristic and unusual features as the painted churches of Sucevit, and Voronet, and the walled nunnery of Hurez. Survivals of weird old sects, émigrés from Russia and Turkey, the life of the Roumanian Jews and especially his encounters with the gipsy tribes interested Mr. Sitwell tremendously, an interest shared by his travelling companions, A. Costa and Richard Wyndham, among whose superb photographs many striking gipsy faces and groups appear. Mr. Sitwell describes graphically his progress through the country, his visits to great country houses, to Bucarest, Jassy and other cities and towns, enriching the chapters with history, art and tradition, often gleaned from subsequent studies and from patriotic Roumanians met by the way.

(Continued on page VII)

Our author concludes: "When all is said and done the integrity of the peasant population, the popular music of which I became so fond, the country fairs, the picturesque Laetzi, the lovely landscapes of Oltenia, the great plain of Transylvania and the Danube Delta, these after all are Roumania. It is still unspoilt. Under good rule it has limitless possibilities from its untired human stock, who have come safely through the nineteenth century in their pristine state."

Welsh Border Country, by P. THORESBY JONES is volume 5 of the attractive Face of British series published by Batsford of London (1938, 7/6). Travellers in search of an unusual pilgrimage in the mother country will find in this book an ideal guide. The author knows the history and topography of the Border country thoroughly and leads one into many pleasant byways of scenery and tradition. We hear of Tintern Abbey, Llanthony Priory, the Wye and Golden Valleys, Ludlow Castle and the Black Mountains, lovely old towns like Shrewsbury, Hereford, Ludlow and Leominster, of famous warriors "the Lords Marchers," of writers who made their homes in sight of the Welsh mountains and whose works reflect the atmosphere and life of the countryside. There is a quiet humour and some ironic shattering of historic reputations which lighten the more serious passages. Mr. Jones is at his best when he dwells on the impressive beauty of the landscape, the characteristic architecture and native industries of the ten shires. Traversing in turn Cheshire, Shropshire, Herefordshire, Monmouthshire, Flintshire, Denbighshire, Montgomeryshire, Radnorshire, Breconshire and Glamorganshire, he reveals a rich store of moving incidents, and names that made history. The photographs are unusually interesting not only for their beauty but because of the comparative unfamiliarity of the scenery which they depict. There are also a number of line drawings in the text and the endpapers consist of sketch maps of the district. The frontispiece is a charming reproduction of Turner's Llanthony Priory, Monmouthshire.

Those who have followed the progress of the "assults" on Mt. Everest will hear with regret that, owing to adverse weather conditions, the latest expedition, under the leadership of H. W. Tilman, has had to be abandoned. Great hopes were entertained for the success of this attempt after Tilman's heroic exploit in the conquest of Nanda Devi. Before dedicating himself to the Himalayas, Mr. Tilman lived for some years in East Africa where he devoted himself to cattle raising and the culture of coffee. In the intervals of business he satisfied his passion for mountain climbing by accomplishing the ascent of the higher peaks of the region of the great lakes, Ruwenzori, Kenya and Kilimanjaro. In *Snow on the Equator*, (London: G. Bell & Sons, 1937), Mr. Tilman gives an account of his life in East Africa and his intrepid exploits of mountain climbing. Not the least interesting part of the book is the story of the extraordinary crossing of Africa from East to West, from Uganda to Cameroon, which the author accomplished, alone, on foot or by bicycle, collecting as he went a mass of information on the country and natives. The book, full of humour, and, abounding in curious and instructive observations, is illustrated with very fine photographs.

F. E. FORSEY.